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The Air Ministry Prize

IN 1920 the Air Ministry offered prizes of considerable value to encourage the development of civil aircraft. There were three classes in the competition—large landplanes, small landplanes, and amphibians. In the large class the first prize was not awarded, the second went to the Handley Page W.8 with two "Lion" engines, and the third to the Vickers "Vimy Commercial" with two "Eagles." In the second class the three prize-winners were the Westland six-seater with "Lion," the Sopwith "Antelope" with "Viper," and the Austin "Kestrel" with 160 h.p. "Beardmore." The prize-winning amphibians were the Vickers "Viking" with "Lion" engine and the Supermarine amphibian with an "Eagle."

It would be difficult to trace exactly how far our modern developments are due to that competition, though in the winning Handley Page machine we may see the precursor of the "Heracles" class. Nevertheless, it is fairly safe to state that the competition stimulated the brains of our designers, and it also showed that the Air Ministry set store by aircraft of a true commercial class and was ready to give active support to their development. It should be remembered that in 1920 civil flying seemed to be a lost cause, and some official encouragement was sorely needed. Subsidies were not forthcoming, very few people wanted to fly between London and Paris, at least at the fares then charged, an aeroplane which could actually pay its way seemed an unattainable ideal, and the management of an operating company was not a paying concern.

The new Air Ministry offer of a prize of £25,000 for "the best machine produced by a British firm within a stated period of time and complying with certain broad requirements to be formulated by the Air Ministry" comes at a time when circumstances are very different from what they were in 1920. Now air transport is an accepted feature of life. It is recognised as a potent link to bind the Empire together, and suggestions (often too lightly made) that British commercial aeroplanes are not so good as those of foreign nations raise an outcry which puts a valuable card into the hands of certain Press magnates whose ambition it seems to be to dominate the Government. Our designers now know a great deal about commercial properties in aircraft, and a Government competition at this juncture may well do a great deal of good.

Much, in fact almost everything, hangs upon the interpretation put upon the words "good, better, and best." The recent agitation proclaimed that the Douglas and other foreign machines were "better" than any British commercial aeroplanes. The Air Ministry offers a prize for the "best" British machine. We may query the allegation that the Douglas is "better" than any British machine for our special purposes, and we must await with what patience we can a definition of what the Air Ministry means by "best." We feel quite sure that the experts who draw up the terms will guard against the danger of issuing a formula which might enable the prize to be won by an ingenious freak which would not be useful on commercial services. They will doubtless remember that in 1912 the Cody aeroplane won the military trials, but that the War Office decided not to order any of that type for army use.

Improving the Breed

At the same time the fact must be acknowledged that certain competition-winning freaks (the word is convenient and is not meant to be derogatory), such as the winners of the Schneider contests and the winner of the Melbourne race, have done very good service by improving the breed of aircraft. The Air Ministry's decision to have a long-range aeroplane and an altitude aeroplane built is very much to be welcomed. The winner of the £25,000 prize, however, ought not to be a mere competition-winner, but a machine which will actually serve some useful purpose on, we suppose, the Empire air routes. The prize is more than three times as valuable as the prize offered for the Melbourne race, and some very high-performance aeroplanes ought to be produced as a result. More cannot be said until the conditions of the competition are published.

Aerodromes and Cities

THE suggestion put forward by Mr. O. E. Simmonds in the House of Commons, that the Government should spend £20,000,000 on providing three hundred aerodromes in Britain, is certainly audacious. Of course, he cannot have meant that this vast sum should all be provided in one year; but, even so, the mere thought of spending such a sum at such a time as this is enough to make the taxpayer gasp. An extra £10,000,000 is being spent this year on defence, and this has caused an outcry from a vocal minority. The defence Estimates will doubtless be voted, and voted willingly, by the Faithful Commons, but they will be voted with a sigh, as members reflect that they and their constituents had hoped for another sixpence off the income-tax, and that the hope is now dwindling.

Nevertheless, it is never true economy to refrain from a profitable investment, and if it can be shown that the nation may expect greater prosperity when there is an aerodrome beside every considerable town, then the provision of funds ought to be seriously considered. One ought, however, to be clear about the object in view. Among possible objects are (1) the promotion of national or local prosperity, (2) the increase of flying as an end in itself, (3) the provision of a reserve of pilots for defence purposes, and (4) employing some of the unemployed. Of these only the first is a valid reason for expenditure on the scale proposed. The other objects can be better obtained in other ways.

Mr. Simmonds may be congratulated on his frank admission that municipal aerodromes are not assets but liabilities. *Flight* has always hesitated to join in the cry that municipalities should buy quickly or they may be left behind. We may take it, then, that aerodromes beside cities have not yet paid. If they are never likely to pay, then there is scant justification for the nation to rush in where the municipalities fear to tread. Our hope, however, is that along certain routes air lines will promote prosperity, and air lines must have aerodromes. One whole well-thought-out scheme may show a profit where an individual aerodrome will show a loss. Some railways (one in Malaya has been quoted) have never shown a profit, but the whole prosperity of the district depends on keeping the trains running.

Steps have been taken to map out the probable lines of development of internal air traffic in the future. On the basis of such a forecast, it does seem that the State might well undertake the financial responsibility of laying out the routes and equipping them. That is a more hopeful method than the one suggested by Mr. Simmonds of going by the populations of towns, many of which may not require an aerodrome for years to come.

SILHOUETTE: A fine impression of four Blackburn "Baffin" (Bristol "Pegasus M") torpedo-bombers from H.M.S. *Furious* on early patrol during the recent Combined Fleet Exercises.

The Outlook

A Running Commentary on Air Topics

New Licence Categories?

DURING the past few years the necessity for providing different classes of commercial pilot's licence has become more and more obvious. The G.A.P.A.N., in consultation with the Air Ministry, have stated that the present "B" licence is inadequate for to-day's conditions, yet, if a more comprehensive series of tests were set out, it would be quite impossible for every pilot to remain efficient in all subjects. Nevertheless, the "B" licence as it stands is a definite certificate of competency, and the only way out appears to be to increase the number of categories.

By way of a start, the Guild suggests that instrument flying ability is not essential for all work, and the Air Ministry has admitted that a delay in the operation of the Notice to Airmen concerned might be arranged while the whole question is being reviewed.

At present, even with the addition of this instrument flying test, the "B" licence pilot is not necessarily competent to fly airline or charter machines. The airline pilot must also be skilled in subjects that apply solely to his own work and must, in any case, have a greater experience of blind flying than is provided by a course and test. On the other hand, an instructor or a test pilot need not necessarily be competent to fly passengers or mail to schedule, but must be even more experienced in other ways. Every pilot is not always a good instructor or a good test pilot even though he may be the safest of transport pilots.

Studying the Market

IT would be sheer presumption on our part to attempt to teach the directors and shareholders of future internal line companies their own business, but one or two points might be remembered yet again when new services are planned. After all, the failure of an operating company, through lack of traffic, is bad for aviation as a whole as well as for the unfortunate shareholders, and there have been far too many failures or non-starters during the past year of two.

The enthusiastic operator sometimes appears to forget that the prospective traffic will only use his line if by so doing a very useful period of time is saved *at the right time of the day* or if the effort involved in going by air is much less than that in travelling by train and/or boat. In other words, the passenger must be led by the hand; he may even prefer to go by air, but if he knows that a perfectly good express train leaves at a definite time from a station across the road he will obviously use this train.

Experiment Worth Watching

WITH all hope of the unification of the air services of the U.S. Army and U.S. Navy definitely abandoned on the recommendations of the Baker Board, the U.S. Army has undertaken the experiment of organising a "General Headquarters Air Force." The main object of the formation of this body, which will consist of practically all the "combat" units of the Air Corps stationed in the United States, together with certain "observation" and "service" units, is, it would appear, to provide a force of great mobility and striking power ready, as an official announcement puts it, to meet a threat from any direction.

The actual movement of aircraft is but a small portion of the problem of mobility. Supplies, bombs and "servicing" facilities must be available, and suitable aerodromes must be wisely distributed in whatever locality the force may be operating.

General Douglas McArthur, Chief of Staff, who determined upon the organisation of the new force following the evolution of his four-army plan of defence for the U.S.A., has described the body as an aerial fleet that will comprise at least one thousand bombing, "pursuit" and "attack" aircraft. Orders for new equipment to bring it up to strength are already being executed.

Under the new scheme observation squadrons will be controlled by corps commanders of the army and the Chief of Air Corps will be stripped of practically all his units with the exception of schools and depots, leaving him free to handle questions of training, organisation and the procurement of equipment.

One interesting point is that, in all probability, the principles involved in the new step will influence the development of the other American arms, which have not been modernised to the same extent.

Joyless!

ONE often hears talk of the difficulties under which joy-riding concerns have to work in this country. It seems that in Australia people in a similar line of business also have their difficulties; for example, it is understood that in Perth the local transport board take 2½ per cent. of the total takings from those carrying out joy-riding. There is a duty of 7d. per gallon on petrol, and aircraft are all under the control of this local board, which also rules the destinies of all other forms of transport. It is suggested in Australia that their activities are such as to make it appear that their aim is to suppress all transport except the Government-owned railways.

A 7,450-mile Range

WRITING in the French journal *l'Aero*, M. Roger Labric calculates that the actual range of the Blériot long-distance monoplane *Joseph le Brix*, on which Rossi and Codos recently made an unsuccessful attempt to establish a new world's record, is about 12,000 km. (7,456 miles). He points out that the distance from Istres to the Cape Verde Islands, including the return to the islands after the oil pipe broke, was 3,790 miles. After the Hispano-Suiza engineers had put the defect right a test flight of about 310 miles was made before the return flight was accomplished—the petrol tanks, it should be noted, remaining sealed and un-replenished throughout. The distance from Porto Praia to Buc amounted to 2,983 miles, and there were still 118 gallons left in the tanks. Evaporation is thought to have accounted for some 33 gallons. When the machine took off from Istres it had on board 1,375 gallons instead of the full 1,430 gallons.

Taking all these facts into consideration, the French writer thinks it fair to assume an actual range of the *Joseph le Brix* of 12,000 km. It may be pointed out that the question of wind is likely to play a very prominent part, and that the range is just as likely to be reduced as increased by it. Rossi and Codos, of course, hold the world's record on this same machine with 5,657 miles.

All this prompts the thought that when the forthcoming British long-range machine is put in hand, the designers will have to think in terms approaching 8,000 miles.

THE MODERN SUPERCHARGER

How Aircraft Supercharging Differs from Automobile Practice : A Modern Installation—the Rolls-Royce "Kestrel VI" Supercharger—Described : Operation of the Automatic Boost Control

SUPERCHARGING of aero engines has for its object the maintenance of a constant pressure in the induction pipe up to a certain altitude; this, somewhat ambiguously known as the "rated altitude," is the height above sea level at which the engine power falls off due to the decreasing density of the air. In other words, the function of the supercharger is to restore sea level conditions of pressure up to the "rated altitude." Aero engine supercharging differs from the supercharging of motor car engines in that, except for special racing engines and to a limited extent for take-off purposes, the object is not to increase the ground level power of an engine of given capacity but to enable the engine to maintain that power up to heights which will depend upon the degree of supercharge.

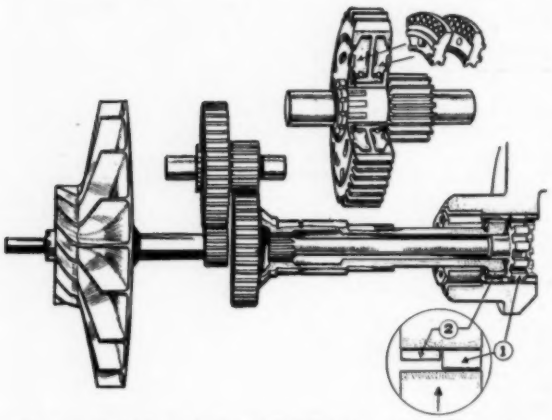
Two main classes of supercharger come under consideration for aircraft work: The displacement type and the geared centrifugal fan. A further sub-division occurs in the second class, which may have its impeller mechanically driven by the engine, or it may have it driven by the exhaust gases from the engine. The last-mentioned type was developed and experimented with by Rateau in France many years ago, and a good deal of work was also carried out in the United States. The type has not, however, come into general use, mainly because of constructional difficulties. The pipe work which carries the exhaust gases from the exhaust valves to the turbine driving the supercharger impeller gets red-hot, and it is difficult to obtain materials which will stand up to prolonged running. There is also a considerable element of fire risk introduced, and a back pressure of two or three pounds causes added heating of the exhaust valves. Theoretically, the exhaust-driven supercharger is attractive, because instead of absorbing engine power it is driven by the energy, normally wasted, which is still left in the exhaust gases.

Experiments have been made to adapt the types of supercharger used in motor cars to aero engine work, but the special conditions obtaining have led to the selection of the centrifugal fan type as best suited to the aero engine.

Fundamentally, the supercharger used on aero engines consists of a multi-blade rotor or impeller, driven at high speed and delivering its charge *via* spaces between a number of deflector blades to a volute chamber or spiral, which in turn delivers the mixture to the inlet pipes of the engine. The actual details of the supercharger differ slightly in different makes, but all depend upon the same general design principles. We have chosen as an illustration of the modern aero engine supercharger that fitted on the Rolls-Royce "Kestrel VI" engine, the details of which were sketched by Mr. Max Millar during a recent visit to the Rolls-Royce works at Derby.

Like the superchargers of other makes, the Rolls-Royce is based upon the original research work done at the Royal Aircraft Establishment at Farnborough, although constant experiment takes place at Derby with a view to improving efficiency and reliability.

The supercharger is bolted to the rear end of the engine, and the impeller, which is of the straight radial vane shrouded type, is driven from the rear end of the crankshaft by a special system of dogs which, in conjunction with the shaft itself, acts as a torsion damper between the crankshaft and the first of the increasing gears, carried on three layshafts. A further stepping-up in gearing is obtained between the layshaft gears and the final gear wheel on the spindle of the impeller.



The impeller drive : In this simplified view of the increasing gears are shown the special dogs and thin shock-damping shaft which smooth out the drive from the rear end of the crankshaft to the layshafts. Only one of the three layshaft gears is shown. These incorporate centrifugal clutches, the details of which are exposed in the upper sketch.

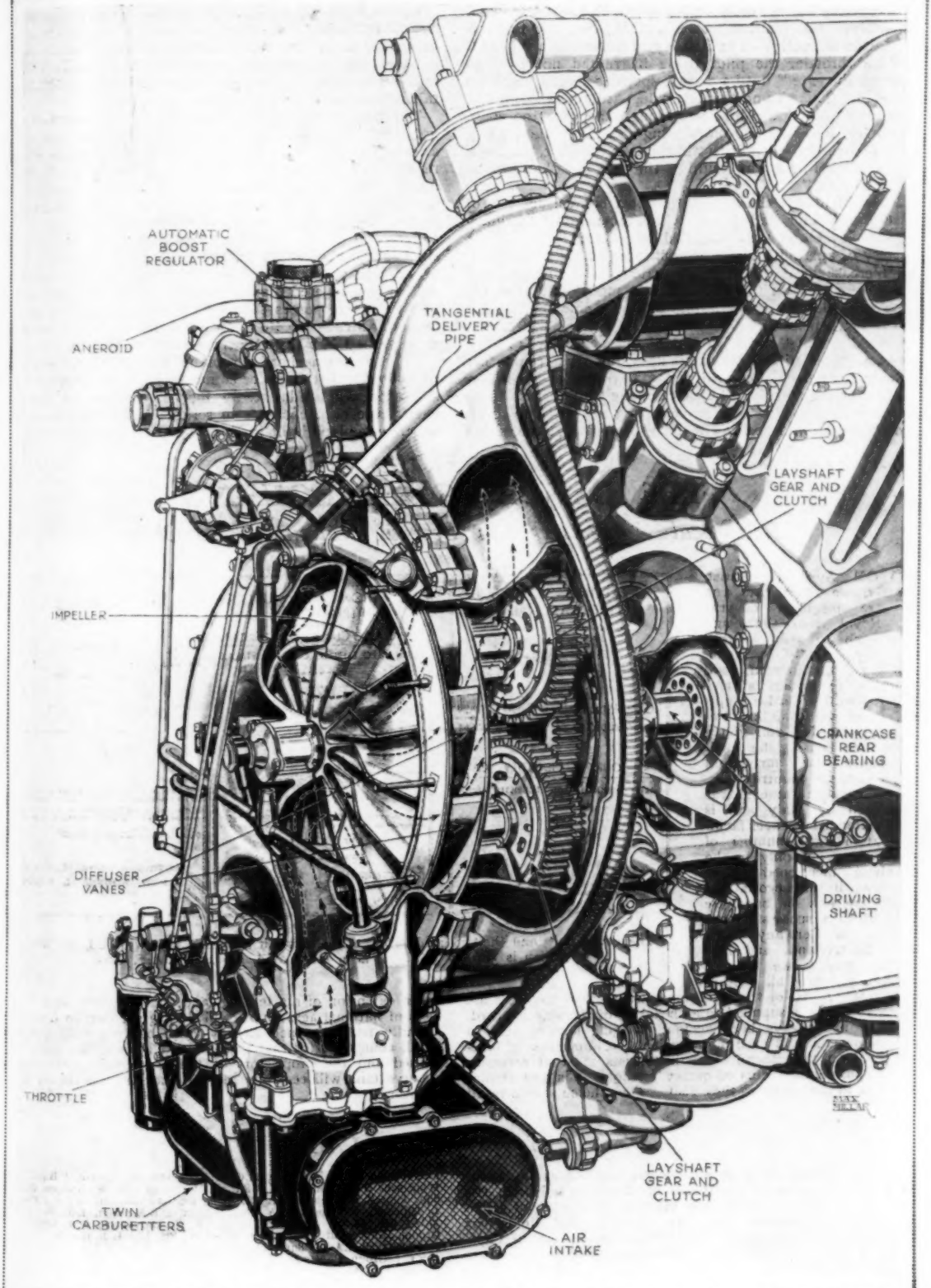
Protecting the Mechanism

It will be obvious that, with such a high gear ratio between the crankshaft and the impeller spindle (8.823 to 1), the inertia of rotating parts is very high, and a sudden opening of the throttle would probably wreck the whole mechanism unless some form of slipping clutch were incorporated. In the Rolls-Royce supercharger the clutches are housed in the gears of the layshafts. They are of the centrifugal type, as shown in the drawing, and provide sufficient friction to ensure steady drive, but prevent damage to the train of gears by slipping when the engine speed is changed suddenly.

The mixture is drawn into the impeller housing from two carburetters, and on being struck by the rapidly rotating vanes of the impeller the particles of the mixture have two movements imparted to them, one centrifugal, as the particles are flung from the centre towards the circumference, and the other tangential, due to the rotation of the vanes. It might be mentioned here that the impeller of the Rolls-Royce supercharger is made of duralumin as regards the main vanes and their shrouding plate. Another set of smaller vanes of smaller diameter are placed centrally on the front of the main impeller. These vanes are bent over, as shown in the drawing, in order to guide the gas mixture as it enters. Owing to the high speeds attained by the impeller (some 22,000 r.p.m.), these bent vanes cannot be made of duralumin. They are of steel and have to be extremely carefully made and hand-fitted.

On leaving the tips of the impeller blades, the mixture has had a spiral motion imparted to it. In order to convert the kinetic energy of the particles into pressure energy, a diffuser with curved vanes is placed around the circumference of the impeller. These vanes guide the mixture into the volute chamber, which is a spiral of gradually increasing cross-section in which the mixture loses velocity and gains pressure before being delivered to the inlet pipe of the engine.

A few moments' contemplation of the function of a supercharger will show that if the throttle is opened fully near the ground the engine will receive a considerably increased



THE ROLLS-ROYCE SUPERCHARGER : Principal features of the "Kestrel VI" installation described on the opposite page.

charge, and the stresses imposed might readily be sufficient to wreck the engine, or, at any rate, to reduce its life considerably. Two distinct methods have been used to overcome this difficulty. The first lay in providing a " gate " for the throttle, the pilot being instructed not to " go through the gate " until a certain specified height had been attained. This was no absolute safeguard, as a pilot might disregard instructions and go through the gate too soon. Moreover, it meant one more thing for the military pilot, already overburdened with things to remember, to think about. A solution was found in the so-called " automatic boost control."

Fundamentally, the automatic boost control consists of a servo cylinder and piston which operate an auxiliary throttle lever and are controlled by aneroid pressure. A battery of aneroid capsules is connected to a piston valve. An increase or decrease in the rated boost pressure will collapse or expand the capsules, the movement of which causes the piston valve to admit air to one side or the other of the servo piston.

Actually, the " gate " is not abandoned entirely, even when automatic boost control is used, but it is used rather differently to limit the relatively small degree of boost permitted for taking off. The effect of the gate in this case is to allow the capsules to be moved along to a position corresponding with mid-position of the piston valve at the degree of boost pressure which is permitted for the take-off.

In the Rolls-Royce supercharger the servo piston of the automatic boost control is pneumatically operated, use being made of the difference in pressure which exists between the supercharger inlet and delivery pipes. Other makes use oil for operating the servo piston, the oil being taken from the main engine lubricating system.

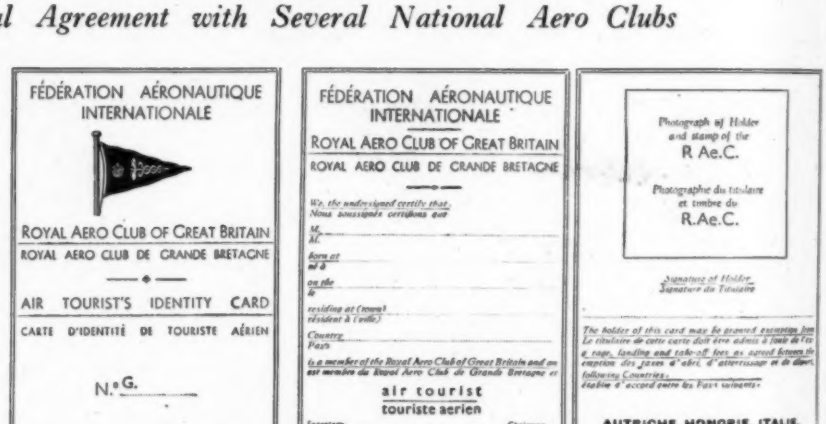
The single-stage supercharger of the type described cannot readily be made to maintain sea level pressure up to altitudes greater than about 12,000 ft. There are several reasons for this, the chief being that at very much higher impeller speeds and dimensions than those at present in use the tip speed of the impeller would approach or even exceed the speed of sound, at which the efficiency would suffer. To obtain higher ceilings than those provided by single-stage superchargers, the experiment has been tried of working two superchargers in series. Among the difficulties encountered may be mentioned that of cooling the mixture as it passes from the first supercharger to the second. Mr. Wiley Post, on his recent flights, is reported to have had two superchargers fitted in this manner, and when the stratosphere aeroplane which the Air Ministry recently decided to order comes to be built, its engine installation will undoubtedly incorporate two or possibly even three superchargers in series. The Farman stratosphere aeroplane built in France had such an arrangement.

FREE LANDINGS and HOUSING

Reciprocal Agreement with Several National Aero Clubs

FROM April 1, British private air tourists who are members of the Royal Aero Club and who wish to visit Austria, Hungary, Italy, Japan, Rumania, or Sweden, will be able to obtain a new F.A.I. Identity Card exempting them from landing fees and take-off fees and giving them free housing for their aeroplanes for forty-eight hours in those countries.

This excellent scheme was originated by Italy and is being extended to cover facilities at a large number of aerodromes, not only in the countries mentioned above but also, if the negotiations which are now in hand are brought to a successful conclusion, in Germany, Holland, Switzerland, and Belgium, and, we hope, ultimately in all other countries. A list of the aerodromes where these facilities are obtainable will be supplied to each holder of the identity card.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following Countries:
établie d'accord entre les Pays suivants:
AUTRICHE, HONGRIE, ITALIE, JAPON, ROUMANIE, SUEDE

The cover (left) and the two inside pages of the new Air Tourist's Identity Card, the size of which is 3in. by 4½in. It is of stout card, coloured R.A.F. blue.

Flight has always been against charging landing fees to private owners (and even more against the imposition of take-off fees), on the ground that air tourists must of necessity spend considerable sums of money on hotel bills and similar expenses in the countries they visit. The scheme should result in an extension of air touring, and, as it is confined to members of national aero clubs, will do a great deal to foster the friendly feelings which already exist between such members in all countries; for that reason the officials of the clubs concerned and the proprietors of the participating aerodromes deserve (and will certainly receive) the sincerest thanks of all aviators.

AT ST. JAMES'S PALACE

BY command of the King, a levée was held last Friday at St. James's Palace by the Prince of Wales on behalf of His Majesty. Among those in attendance upon His Royal Highness, and also present, were: Air Chief Marshal Sir Robert Brooke-Popham, Principal Air Aide-de-Camp; Group Capt. T. E. B. Howe, Aide-de-Camp in Waiting; and the Secretary of State for Air. The following were among those presented to the Prince of Wales:—

Wing Cdr. R. Aitken, M.C., A.F.C.; Flt. Lt. E. Barnes, A.F.C.; Air Comdre. A. Barratt, C.M.G, M.C.; Air Comdre. C. Breese, C.B., A.F.C.; Wing Cdr. O. Bryson, M.C., D.F.C., A.M.; Wing Cdr. W. Budgen, O.B.E.; Sqn. Ldr. E. Carpenter, A.F.C.; Wing Cdr. J. Coleman, A.F.C.; Flt. Lt. L. Crocker; Air Comdre. A. Cunningham, C.B.E.; Sqn. Ldr. W. Fisher, M.C.; Flt. Lt. G. Francis; Flt. Lt. F. F. Garraway; Sqn. Ldr. V. E. Groom, D.F.C.; Lit. Lt. P. J. H. Halahan; Flt. Lt. M. L. Heath; Sqn. Ldr. J. Hewitt, R.A.A.F.; Sqn. Ldr. F. L. Hopps, A.F.C.; Flt. Lt. McKewer, D.F.C.; Group Capt. A. C. Maund, C.B.E., D.S.O.; Flt. Lt. J. W. F. Merer; Flt. Lt. K. Niblett; Flt. Lt. J. S. Phillips; Flt. Lt. R. Pyne; Flt. Lt. D. N. Roberts; Sqn. Ldr. H. J. Saker; Sqn. Ldr. C. Strafford, D.F.C.; Group Capt. A. A. B. Thompson, M.C., A.F.C.; Flt. Lt. S. E. Ubee; and Sqn. Ldr. C. H. C. Woolven, M.C.

THE "FOOL-PROOF" AEROPLANE

The Mignet *Pou-du-Ciel* in flight

A Simple Explanation of Fundamental Principles: How the "Pou-du-Ciel" Works

MORE than twenty aeroplanes of the *Pou-du-Ciel* type are now being built, and two or three of them have made their preliminary test flights. The Air League of the British Empire has formed a "Pou Club," and before long it may be expected that the first British-built machine will take the air. In view of the interest being taken in this machine (the first description of which in the English language appeared, incidentally, in *Flight* of September 20th, 1934), a few elementary explanations of the principles upon which this unorthodox design is based may be of assistance to those who had not previously dreamed of becoming "aircraft constructors." One word of warning may prevent disappointment: If the directions in the book written by the inventor, M. Mignet, are followed closely, no serious trouble need be expected. If considerable changes are made, such as in the size and weight of the power plant, the trim of the machine may be upset and instability, or at least less nice handling, may result. Intending builders should consult the Air League first.

The idea of using aerofoils placed in tandem occurred to the very first designers of aeroplanes. The so-called "aerodrome" designed and built in America by Samuel Pierpont Langley in 1903 had its two wings arranged one behind the other. A diagrammatic side elevation of the Langley machine is given in Fig. 1. While the tandem arrangement of the wings was intended to give longitudinal stability, the pronounced dihedral angle of the wings was used for lateral stability.

In his very earliest work the late Gustave Eiffel, the builder of the Eiffel Tower and founder of the Eiffel Aerodynamic Laboratory, tested a large number of wing arrangements, and these included several with the wings placed in tandem. In order to understand the way in which fore-and-aft stability is obtained by wings in tandem, it is necessary to consider for a moment the action of the air on a wing. As *Flight* readers will know, many new aeroplane wings are first tested in model form in a wind tunnel to determine their characteristics of lift, drag and centre of pressure movement.

A typical lift curve obtained in this manner is shown in Fig. 2. It will be seen that from very small negative angles of incidence to an angle of approximatelv 15 deg. the lift increases approximately directly as the angle of incidence. At 15 deg., however, there is a sudden change in the lift curve. This is caused by what is known as "burbling," which is a break-away of the airflow from the surface of the wing. If the angle is further increased the lift drops off rapidly and leads to what is known as a stall. The lift curve shown in Fig. 2 is one having a very sharp peak. If used on an aeroplane this sudden drop in lift after the stalling angle is passed would result in the machine stalling, *i.e.*, losing lift, quite suddenly. It would most likely also result in the machine starting a spin. Not all wing sections have lift curves with such a sudden change in the curve at the angle of stall; some of them show a quite gradual falling off in lift, and this is an advantage, in that the loss of lift is less sudden.

If one takes two aerofoils and arranges them in tandem as shown in Fig. 3, with both wings set at the same angle of incidence and both carrying the same loading per square foot of lifting area, both would stall at the same moment when the combination had reached stalling angle. This statement is not strictly true because of what is known as the "downwash." Behind any wing the air is deflected downwards and follows a sloping path for some distance downstream. Actually, in the arrangement shown in Fig. 3, the rear wing, although apparently being at the same angle as the front wing, would not be so in the aerodynamic sense because it is situated in the downwash from the front wing and therefore virtually at a smaller angle in relation to the air in which it is working than the actual geometric angle would indicate.

If the front wing of a tandem combination (see Fig. 4) is set at a larger angle than the rear wing and both are carrying the same weight per square foot, it will be obvious that if the two wings are assumed to have the characteristics shown in Fig. 2 the front wing will reach its angle of maximum lift first. Let us assume that it has reached an angle of 18 deg. From the curve it will be seen that the lift coefficient has then dropped to 0.5. If we assume that the difference in angles between the front and rear wings of Fig. 4 is 3 deg., the angle of the rear wing will be 15 deg. when that of the front wing is 18 deg. In other words, disregarding the effects of downwash, the rear wing will be at its maximum lift coefficient of 0.6 at the same instant that the front wing has passed its angle of maximum lift and its lift coefficient has been decreased to 0.5.

While the rear aerofoil continues to carry its load the front wing is no longer able to do so and the machine begins to drop its nose. As soon as it has done this, however, it begins to gather forward speed, and in doing so it will, after a time, come out of the dive and begin to go into a climb again. This undulating flight path will, in a stable combination like that shown in Fig. 4, gradually damp itself out until the aeroplane settles down to a steady flight path again.

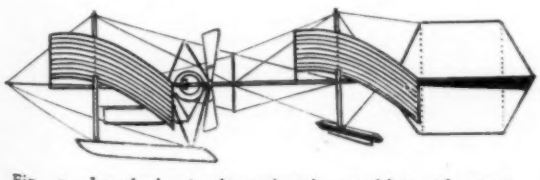
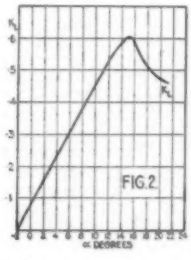


Fig. 1.—Langley's tandem-winged machine of 1903.



(Right) Lift curve and tandem-wing arrangements

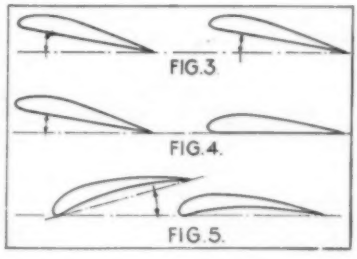
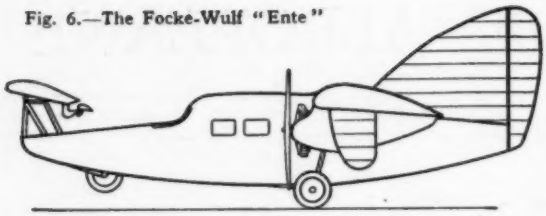


Fig. 6.—The Focke-Wulf "Ente"



From the foregoing it will be seen that with a tandem aerofoil arrangement it is only part of the wing area which stalls at any given time, *i.e.*, the front one. Any tendency which the front wing might have to go into a spin is resisted by the rear wing which is still carrying its full load, and the combination is not, therefore, likely to spin unless the relative angles of the two aerofoils are too close together or unless the wing loadings of the two are too nearly equal. If that is the case there is always a possibility that unpleasant characteristics might develop, and in order to make quite sure of avoiding these, designers who have produced tandem aerofoil machines have always provided for a considerably greater load per square foot of the front wing than of the rear.

From an aerodynamic point of view the tandem arrangement is not as efficient as that of a monoplane wing because the rear wing works in disturbed air and is not carrying as much load as the front one, so that full use is not being made of both wings at any given angle.

Shortly after Mr. Handley Page introduced the leading-edge slot for the purpose of preventing the air from breaking away from the wing at large angles, the Aeronautical Research Committee had certain experiments carried out on tandem arrangements of aerofoils. For the best efficiency it was found that the front aerofoil should be at a negative angle relative to the rear wing, as shown in Fig. 5. This combination of aerofoils was very nearly stable over a large range of angles of incidence, but at very small angles the centre of pressure of the combination was found to move back suddenly, and in order to make the combination stable it would be necessary to use a tail. The main advantage of the arrangement was that a very considerable increase in maximum lift coefficient could be obtained. According to the published results (R. and M., No. 804, March, 1922) the maximum lift coefficient of the combination was in excess of 0.8 for certain arrangements of gap and stagger, while with the two wings placed immediately behind one another the maximum was 0.5.

The object of these experiments was not at the time so much that of getting fore and aft stability as that of getting a high maximum lift coefficient so as to retain a low landing speed combined with a high wing loading.

A "Tail-first" Type

A practical arrangement making use of tandem wings was used in the German Focke-Wulf "Ente," produced some years ago. This machine paid a visit to this country, during which the present writer was privileged to make a flight in it, and there was certainly no doubt whatever about the longitudinal stability. When a certain angle was reached the front wing stalled mildly, the machine began to gather speed, and soon stability was restored. From Fig. 6 it will be seen that the front wing was quite a small one, while the main rear wing was large. Actually, the difference was greater than shown in the sketch, because, in addition to having a very small chord, the front wing also had quite a small span. To get the relative loadings of the front and rear wing right, the centre of gravity of the machine had to be fairly far back. For purposes of directional stability this fact necessitated the use of a very large fin and rudder behind the main wing, and, in addition, fins were placed under the wing. The machine was not of very high aerodynamic efficiency, but this was not a necessary consequence of the tandem arrangement.

In the *Pou-du-Ciel*, shown in Fig. 7, M. Henri Mignet has made use of a combination of the various principles outlined in the foregoing notes. Not only has he arranged his wings in tandem, but by placing the front one slightly above the rear one he has, he claims, obtained a slot effect. When the trailing edge of the front wing is pulled down it approaches closely to the leading edge of the rear wing, and the claim is that the high velocity caused by the slot thus formed prevents the air from breaking away on both front and rear wings. Whether or not this claim can be substantiated it is impossible to say, but from the fact that M. Mignet has carried out model tests in a wind tunnel which he himself has constructed one is inclined to think that he may conceivably get the effect which he claims.

By placing his main weights well forward, the centre of gravity of the combination is somewhere below and behind the line of the windscreen, so that the front wing, which is a good deal larger than the rear, is more heavily loaded per square foot of wing surface. The reason for using a reflex curvature in the wing section is that a wing with this profile has a stationary centre of pressure. If a wing of the ordinary curvative were used the centre of pressure would move back as the angle of incidence decreased, and the load on the

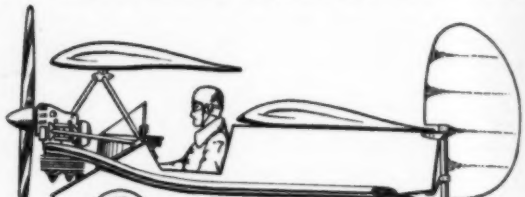


Fig. 7.—The latest tandem-wing development—M. Mignet's *Pou-du-Ciel*. The dihedral angle of the wings is not shown.

control stick would be very much increased and might possibly become too great for the pilot.

Having solved the problem of longitudinal stability by using a tandem wing arrangement, and that of fore and aft control by pivoting the front wing, M. Mignet attacked the subject of lateral stability. Experience with a number of orthodox aeroplanes had convinced him that the usual types of control—elevator, rudder and ailerons—were too complicated for the average man to master easily. To make a correctly banked turn it was necessary on some machines to increase the bank by using the ailerons, while on others there was a tendency to over-bank and "opposite ailerons" had to be used. The whole process of turning was complicated, and misuse of the controls might easily lead to stalling and spinning. After pondering the subject, M. Mignet said to himself that, as the ailerons were the main cause of the trouble, the solution might lie in suppressing them altogether. But how to provide lateral control? He argued that if the centre of gravity were placed low enough in relation to the centre of side area, the machine would swing its fuselage out on a turn owing to the pendulum action, and if he could hit upon a suitable proportioning of his side areas in relation to the c.g. the machine ought to bank correctly for any radius of turn. Actually this problem took longer to solve than the fore-and-aft stability. Originally he had a fixed fin placed ahead of his rudder and the machine refused to turn. Then one day he took the fin off and with the material made a horn balance for the rudder. On the next flight the machine turned perfectly!

M. Mignet has now got his fuselage and rudder side areas and his dihedral angles on front and rear wing so proportioned that he claims that it is impossible to make an incorrect turn on the *Pou-du-Ciel*. Up to a bank of some 45 deg. the bank follows automatically on the use of the rudder. If an even steeper bank is wanted it is only necessary to pull a little on the stick as in an orthodox aeroplane. The rudder, it will be remembered, is connected to the stick, and the feet are not used at all. On a gusty day the *Pou-du-Ciel* rolls slightly from side to side, but after the pilot becomes accustomed to this it does not worry him, and he merely concerns himself with keeping the machine on its course, and in so doing he corrects the more pronounced rolling movements.

"Pou" Developments

One of the difficulties which builders of the "*Pou-du-Ciel*" will have to face in this country is the selection of a suitable engine. Mr. S. V. Appleby, whose "*Pou*" is progressing fast at Heston, intends to use a new engine which Sir John Carden is designing and building. This is a four-cylinder water-cooled upright unit, very much like a small car engine, and as simple as possible. Weight has been kept down and is expected to be 100lb. for a horse-power of thirty. The drive will be direct. The price, it is understood, will be about £50.

Mr. Appleby is a close and personal friend of M. Mignet, the designer of the "*Pou*," and has built and flown one of the earlier models; he is being kept *au fait* with the latest development and is quite willing to assist, with advice, anyone else who is building.

THE FOUR WINDS

ITEMS OF INTEREST FROM ALL QUARTERS

Australia—England Flight

Mr. H. L. Brook, who took part in the England-Australia Air Race, left Darwin on Sunday in an attempt to beat the solo flight to England of 8 days 9 hours established by James Melrose.

At Coventry

Air-Marshal Sir John Higgins attended a parade of "Old Contemptibles" and an exhibition of the film "Forgotten Men," at Coventry last Sunday. Several R.F.C. veterans attended.

The Open-air Show

It is officially announced that the S.B.A.C. Aircraft Display and Exhibition at Hendon will, as usual, be held on the Monday after the R.A.F. Display, which takes place on June 29. As in the past, admission will be confined to guests of the S.B.A.C.

French Seaplane Disaster

Disaster, similar to that which befell the R.A.F. "Singapore" in Sicily recently, overtook a French seaplane last Thursday, when it crashed in flames close to Brest Harbour, all six occupants being killed. Lord Londonderry has sent a message of sympathy to the French Air Minister.

The Congo Tragedy

M. Renard, Governor-General of French Equatorial Africa, and five companions, who left Brazzaville on March 15 for Coquilhatville on a survey flight and were missing for several days, have been killed. A Belgian pilot found their wrecked machine, together with the bodies of the six occupants, between Bolobo and Mossaka, near the Congo River. The party included Mme. Renard and Col. Bonningue. Lord Londonderry has sent a message of sympathy to Gen. Denain, the French Air Minister.

Twenty-five Years Ago

From "Flight" of March 26, 1910

"At last the Committee of the Aero Club of France, which has been considering the question of rules of the air, have drawn up a report which has been submitted to the French Minister of Works. The chief rules provide that aerial traffic shall keep to a height of not less than fifty metres when passing over buildings; all passing by flyers to be done to the right; aeroplanes to give way to airships; towns not to be passed over except by special permission; all aviators to be examined and licensed, and their machines to bear number plates; all buildings over 150 ft. to show lights at every 50 ft.; names of villages to be painted on roofs of railway stations."

Marseilles-Assouan Flight

Maurice Finat and Paul de Forges, the French airmen, accomplished last week a flight from Marseilles to Assouan in twenty-seven hours.

An Unintended Record

When his æroplane got out of control at a height of 30,000 ft. last week, Flt. Lt. Magnenat, of the Swiss Army, jumped out with his parachute and landed safely.

B.B.C. Flying

Mr. Filson Young is continuing his broadcast talks—"Growing Wings"—on experiences when learning to fly, which he commenced last year. He gave his first talk this year on Monday, and will give two more on April 4 and 8.

"MacRobertson" in England

Sir Macpherson Robertson, K.B.E.—the generous sponsor of the England-Australia Air Race—accompanied by Lady Robertson, is due in London to-day (Thursday). They journeyed from Australia in the Orient liner *Otranto*.

Night Gliding

Mr. Christopher Nicholson, of the London Gliding Club, carried out a night flight in a glider at Dunstable in the early hours of Sunday last. He was in the air for forty minutes, and landed by the aid of motor car headlights and signals to the ground with a flash lamp.

The Royal Tournament

As on previous occasions, the Royal Air Force contribution to this year's Royal Tournament, which opens at Olympia on May 9 (and closes on May 25), will be one of those remarkable displays by the School of Physical Training, Uxbridge.

To the Four Winds

In compliance with her last request, the late Miss Kathleen Gower, of Chelsea, who had been a regular traveller on the European and Empire airways, was cremated and her ashes dispersed from an aeroplane flying 2,000 ft. over the Channel.

A Solent Adventure

Two nineteen-year-old Manchester undergraduates hired a sailing boat from Hamble last week, and were swept by the tide towards the sea and were unable to return. Later a search for them was carried out by speed boats and two aeroplanes, one of the latter eventually locating the boat moored to a buoy which the two unfortunates had made their temporary "harbour of refuge."

FOR "SPORT-FLYING": Under the management of Mr. R. Kronfeld, production of the "Drone," an ultra-light aeroplane (600 c.c., 14 h.p. Douglas engine) has been resumed at Hanworth by B.A.C. Ltd. The machine was first designed by the late Mr. C. H. Lowe-Wylde. Mr. Kronfeld shortly hopes to make some long flights with the "Drone," which is a machine that should be most suitable for recreational flying and will be seen at most flying clubs during the coming season. (*Flight* photograph.)

THE AIR ESTIMATES INTRODUCED

Some Noteworthy Points from Sir Philip Sassoon's Speech in the Commons Last Week : The Debate : Mr. Winston Churchill as Critic

TOUCHING upon the much-vaunted efficiency of American aircraft, Sir Philip Sassoon, Under-Secretary of State for Air, made some pertinent comments in his speech introducing the Air Estimates in the House of Commons on Tuesday, March 19.

A brief résumé of the speech was given in last week's issue of *Flight*, while the Air Estimates were set out in detail in the issue of March 7. Below are given some further points from Sir Philip's speech.

Sir Philip said that, for the first time since it had been his privilege to introduce Air Estimates, he was presenting Votes which provided for a substantial accession to the air strength of the nation. He pointed out that much confusion had been caused by the varying methods which different nations followed in stating their aircraft programmes. When the United States spoke of adding so many hundred aircraft to their air services those figures did not simply represent additions to first-line strength, but the total number of aircraft to be held, including replacements and reserve machines. If we adopted the American method he might say that we should be ordering well over 1,000 machines for the R.A.F. in 1935 alone. First-line strengths were far from being the only criterion. In other factors we could still challenge comparison with any other nation.

Sir Philip mentioned a report by a powerful independent Commission which had just been investigating the whole field of aeronautics in the United States. He quoted the following passage:—

> The past year has been marked by incessant attack, using every available medium of publicity, upon the quality of American military aircraft. It has been alleged that they are in every essential respect hopelessly inferior to corresponding machines of European origin. It is an interesting commentary on the state of the public mind that these charges seem to be essentially similar to those being made at the same time in the very countries which have been held up to the United States as examples to imitate. The Press of Great Britain has rung with assertions of the remarkable qualities of American aircraft and the inability of the available British military types even to keep pace with American commercial machines. In France a section of the Press has debated furiously the rumoured inferiority of French military aircraft to those of most of the rest of the world.

In Good Company

"I take some comfort," remarked Sir Philip, "from the fact that our own stern critics of all we do, of all we have, and of all we are, apparently have their precise counterparts the world over. So that, if these critics have their way and we are to be court-martialled because of the alleged deficiencies of the Royal Air Force, we may at least hope to face the firing squad in the excellent company of those responsible for the American, French, and other military air services!"

Continuing, Sir Philip said that they had had to take special steps to shorten the time hitherto taken to bring new types into production, and that they were confident that the British industry would rise to the occasion. No fewer than 29 foreign countries were using British aircraft, and 33 were using British engines, whilst the value of our exports rose in 1934 by 31 per cent. The first-line strength of the R.A.F. to-day was about 890 machines in regular squadrons plus about 130 machines in non-regular squadrons, or 1,020 in all. This year's programme would bring it up to 1,170 and the 1936 programme would bring it to 1,310.

Turning to civil flying, Sir Philip mentioned again the advances in 1934 and the programme of future developments, which has been made public. He pointed out that in the last two years Imperial Airways had carried across the Channel a substantially larger number of passengers than all their foreign competitors combined. The weight of letters sent by air from this country in 1934 was the largest ever recorded, namely, 122 tons, an increase of 43 per cent. This represented nearly six million letters.

Sir Philip mentioned the formal ratification of a ten-year agreement with Italy which would enable Imperial Airways to fly freely over Italian territory. An understanding with France which would be the basis of a similar agreement was arrived at shortly before Christmas. Within the next month or two Imperial Airways planned to operate an interim service through to Brindisi with small aircraft, primarily for the carriage of mails. A full service by large aircraft could not be brought into operation until the fleet had been increased, owing to the duplication of the African and Indian services.

During 1934 seventeen different companies had operated inland air services in the United Kingdom. Sir Philip created a surprise by stating that, "on a basis either of our respective national incomes or of our populations, there are proportionately more private pilots' licences current to-day in this country than in the United States."

Of the new services which are contemplated, Sir Philip said that no other country in the world had yet formulated plans for the carriage of the bulk of first-class mail by air without surcharge. The new programme would entail the raising of anything up to two million pounds of capital, the bulk of which would go to the provision of a new fleet.

Sir Philip gave figures of American expenditure on civil flying, which were dealt with in *Flight* of March 14 under the heading "An American Stocktaking." He then made the announcement, which was published in our last issue, of a Government prize of £25,000 for the best medium-sized commercial transport machine produced by any United Kingdom firm within a stated period.

Mr. Churchill's Remarks

The only really important speech in the debate which followed was that of Mr. Winston Churchill. He said that nothing was more notable in the Under-Secretary's speech than what he had left out. They were all deeply exercised in their minds about the relative strength of the German and British Air Forces. He said that there was no difference between the Government and those who supported the Government, because Mr. Baldwin had said that the Government would see to it that in air strength this country should no longer be inferior to any country within striking distance of our shores.

Mr. Churchill questioned the figures of German air strength which Mr. Baldwin had quoted in November last. He objected to the machines of non-regular squadrons being counted as first-line strength, saying that they were not fairly comparable with the whole-time units of the R.A.F. He foretold that the true position at the end of this year would be almost the reverse of what Mr. Baldwin had stated to Parliament (namely, that by November, 1935, this country would have a margin of nearly 50 per cent. in Europe alone over the German total of aircraft).

The frontiers of Germany were very much nearer to London than the sea coasts of this island were to Berlin, and whereas practically the whole of the German bombing air force could reach London with effective loads of bombs, very few, if any, of our aeroplanes could reach Berlin with an appreciable load of bombs. He did not think that Mr. Baldwin's pledge of our not being inferior to any country within striking distance was being kept, or would be kept, because the efforts being made would not be made by this country alone. The provision for this year was hopelessly inadequate.

In his reply Sir Philip Sassoon said that he could not follow Mr. Churchill into a morass of figures which must be very largely conjecture. According to the latest information in their possession it was not correct to say that at the end of this year the German air force would be fifty per cent. stronger than we were either on a basis of first-line strength or in total aircraft. Our programme was flexible, capable of being either increased or decreased as emergency required. They hoped after the visit of the Foreign Secretary to Berlin to know what figure of strength Germany would give, and it was presumed that the Foreign Secretary would be able to give the House a clearer picture of what was rather confusing and complicated at the moment.

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THE AUTOMATIC PILOT: AILERON CONTROL

Application of the Gyroscope : Avoidance of Errors Due to Accelerations

By G. R. M. GARRATT, M.A. (CANTAB.)

IN a recent article in these pages* there appeared a description of the automatic pilot which is now extensively used throughout the Royal Air Force. For various reasons, however, it was only possible at that time to describe that part of the mechanism which controls the rudder and elevators, and while it is true that the performance of many aircraft is entirely satisfactory for most purposes when fitted with automatic rudder and elevator control only, it cannot be denied that a very appreciable improvement in the control results from the employment of the aileron control in addition. For many purposes the control of the ailerons is absolutely essential if complete stabilisation is required.

Where a high degree of stabilisation is required, such as is necessary, for example, in accurate aerial surveying, full gyroscopic control of all three axes is essential, no matter what degree of inherent stability may be possessed by the machine. Unless the ailerons are controlled, the damping by lateral oscillations and the correction of a disturbance is influenced solely by the characteristics of the aeroplane. However, in the case of a machine the ailerons of which are controlled, the damping of an oscillation is considerably improved, and it is probable that the initial disturbance will never reach the same magnitude as in the case of a machine with uncontrolled ailerons. The accuracy of control which can be achieved by a human pilot is limited by the fact that he can detect a disturbance only after it has grown to a considerable magnitude, and quite a considerable time interval must elapse before he is able to apply the necessary correcting movements to the aircraft controls. The gyroscopic pilot, however, detects the slightest deviation or disturbance instantaneously with its occurrence, and almost simultaneously applies the necessary correcting movements to the controls. Consequently, the effect of any given disturbance is kept within very small limits and a very high degree of stability is achieved.

There are several possible forms which a mechanism designed to control the ailerons of an aircraft might take. It might, for example, be designed to carry out flat turns or to bank the aircraft to the correct angle during a turn. It might be made directly or indirectly dependent upon the direction of apparent gravity, or it might employ a gyroscope, the spin axis of which might serve as a datum to which disturbances of the aircraft are referred. But while various simple mechanisms might be devised with partial success to relieve the pilot to an appreciable extent, the gyroscope alone stands pre-eminent as an instrument of precision, capable of maintaining a perfectly stable datum and capable of controlling the aircraft with the utmost accuracy, no matter how violently the machine may be disturbed by prevailing conditions.

In view of its standing as an instrument of precision the gyroscope was chosen as the fundamental unit when the work of developing an accurate aileron control was first commenced. In the description which follows, the manner in which the somewhat complex principles of the gyroscope have been applied and the manner in which the comparatively large accelerations experienced on an aircraft have been prevented from disturbing the accuracy of the datum will be made clear. The reader will be assumed to have at least a superficial knowledge of the principles of the simple gyroscope. A brief account of the properties of the gyroscope was given in the previous article, but for a more detailed account the reader must refer to a text-book of mechanics.

The familiar applications of the gyroscope, such as, for example, the stabilisation of a ship, make use of the dynamic stability of the gyroscope directly for achieving the required stabilisation. For aircraft purposes, however, the gyroscope forms only a stable datum. Deviations from the datum are detected by sensitive air valves which govern the movements of the control surfaces of the aircraft.

Accurate definition of the vertical is the underlying principle of the aileron control. By means of the gyroscope and

*The Aircraft Engineer, July 24th and August 30th, 1934.

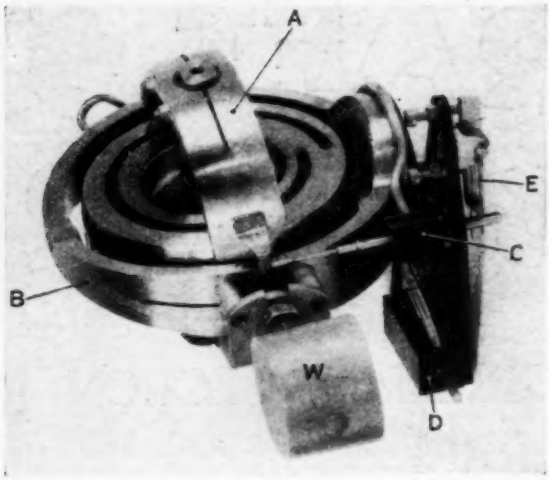


Fig. 1. View of gyroscope and erecting mechanism from beneath

its associated mechanism an imaginary vertical line is defined with a high degree of accuracy, and when the aircraft rolls as the result of some atmospheric disturbance or other cause, a delicate valve detects the departure of the machine from the defined vertical, and, through suitable mechanism, applies the ailerons to correct the disturbance. The apparatus is designed to maintain the aircraft laterally level with a tolerance of only ¼°, both during straight flight and during turns.

The function of the mechanisms which form the aileron control unit divide naturally into two main divisions. The first part is that section of the gear which comprises the actual gyroscope and the erecting mechanism. The sole function of this part of the apparatus is the accurate definition of the vertical and the provision of a stable datum to which disturbances of the aircraft are referred. The second part of the control consists in that part of the mechanism which detects a disturbance of the aircraft relatively to the gyro datum and which applies a movement to the ailerons in proportion to the magnitude of the disturbance.

That section of the apparatus which is concerned with the definition of the vertical will be considered first. Then, having shown the manner in which the gyroscope defines the vertical, the means which are employed to adapt the gyro-vertical to the control of the ailerons will be explained.

The gyroscope, like that of the rudder and elevator unit, is designed to spin at a speed at 11,000 r.p.m. under an air pressure of 35 lb /sq. in., and is carried in ball bearings in a pair of pivoted gimbal rings at right angles to each other. The assembly of the gyroscope in the gimbal rings may be clearly seen in Fig. 1, but in looking at this illustration it should be noted that when the gyroscope and gimbal rings are actually assembled in the aileron control and installed in the aircraft the axis of the gyroscope lies horizontally with the planes of both gimbal rings vertical. The weight W hangs beneath the gyroscope as shown in Fig. 2. Fig. 1 shows the gyroscope assembly from an unusual angle in order to show the erecting mechanism on the right-hand side.

As may be seen in Figs. 1 and 2, the gyroscope is actually carried on its bearings by the inner gimbal ring A, and is so mounted that the axis of the gyroscope lies horizontally and athwartship of the aircraft. The inner gimbal ring is supported on hardened steel pivots in the outer gimbal ring B in such a manner that the line of the pivots is vertical. The inner gimbal ring is permitted a certain degree of freedom about the vertical axis.

It will be noticed in Fig. 1 that there is a small valve C which is carried on a small plate attached to the outer ring. The function of this valve is to detect any relative movement between the inner and outer gimbal rings such as will occur when the aircraft commences a turn. Since the inner gimbal ring and gyroscope are freely supported about the vertical axis, any deviation of the craft from a straight course results in relative movement between the inner and outer gimbal rings, since the dynamic stability of the gyroscope tends to cause its axis to remain fixed in one direction.

Compressed air is supplied to the detector valve at a pressure of 35 lb. per sq. in. by the pipe which may be seen entering the valve from the top in Fig. 1, while beneath the detector valve may be seen two pipes which lead from the detector valve to either end of a small double-acting piston and cylinder known as the precessing cylinder D. The precessing cylinder contains a small piston which is connected by a link (not shown) to part of the framework which supports the outer gimbal ring.

When relative movement takes place between the inner and outer gimbal rings as the result of the aircraft turning, the piston of the detector valve C is slightly displaced from its normal central position, and compressed air is thereby admitted to one or other end of the precessing cylinder D according to the direction in which the relative movement between the inner and outer gimbal rings has occurred.

The outer gimbal ring B is itself supported on hardened steel pivots in a part of the framework known as the "follow-up" frame, which will be described later. The line of the pivots of the outer gimbal ring lies parallel to the fore-and-aft axis of the aircraft, and, since the outer gimbal ring is freely supported in the follow-up frame, it will be seen that when the aircraft rolls about its longitudinal axis, then relative motion must occur between the outer gimbal ring and the follow-up frame.

The piston of the precessing cylinder which was referred to above is connected by a link to a point on the follow-up frame, with the consequent result that when compressed air is admitted to the precessing cylinder by the action of the detector valve a torque is applied to the outer gimbal ring about its axis in the follow-up frame. The consequences of this torque will be understood later.

Keeping the Weight Vertical

A further important component of the erecting mechanism is the small spring device which may be seen at E in Fig. 1. As may be clearly seen, the spring consists of a somewhat delicate hairpin-shaped wire, the exact setting of which is of considerable importance to the correct functioning of the control. It will be seen that the piston rod of the detector valve is continued right through the valve, and a projection on the extension of the piston rod engages with the arms of the hair spring in such a manner as to offer slight opposition to any displacement of the inner gimbal ring from its normal position at right angles to the plane of the outer ring. In normal use the two gimbal rings are orthogonal, i.e., at right angles, but when the inner ring is displaced relatively to the outer ring from the normal orthogonal position, not only is the detector valve operated as already described but the hairpin spring exerts an opposing torque which tends to return the inner gimbal ring to its normal position. The effect of this torque will be appreciated later.

It has been stated earlier in this article that the fundamental principle underlying the operation of the aileron control is the definition of the vertical and the gyroscopic system described above is the means by which a very accurate and stable definition of the vertical is obtained provided that certain essential conditions are observed. There are numerous ways in which a mechanism for defining the vertical with varying degrees of approximation could be achieved, but most of them would suffer from certain more or less serious disadvantages for aircraft purposes. Let it suffice, however, to note that once a convenient means for

the definition of the vertical is achieved, it is a simple matter to utilise such a mechanism for controlling the ailerons of an aircraft. It is necessary now, however, to describe the manner in which the gyroscopic mechanism described above succeeds in achieving an accurate definition of the vertical.

In order to visualise the manner in which the gyroscope maintains a constant definition of the vertical, it is perhaps easiest to consider the sequence of events which occurs if, for any reason, the weight W is displaced from the vertical

Let it be supposed that the aircraft is flying on a straight and steady course, and that, in some manner, the weight W has been displaced from the vertical. Remembering that the axis of the gyroscope is situated athwartship of the aircraft and that the pivots which support the outer gimbal ring are placed parallel to the fore-and-aft axis of the aircraft, it will be clearly seen that the displaced weight W will exert a gravitational torque on the outer gimbal ring. The effect of this torque about the longitudinal axis is to initiate a precession of the gyroscope and the inner gimbal ring about the vertical axis of the inner gimbal ring, thus causing the gyroscope and the inner ring to depart from the normal position orthogonal to the outer gimbal ring. However, precession of the inner gimbal through a very small angle from its normal position at right angles to the outer ring brings the detector valve C into operation and permits the admission of compressed air to one side or the other of the precessing cylinder D, according to the direction in which the weight W is displaced. The admission of compressed air to the precessing cylinder causes a torque reaction to be applied about the axis of the outer gimbal ring in such a sense as to oppose the gravitational torque due to the original displacement of the weight W.

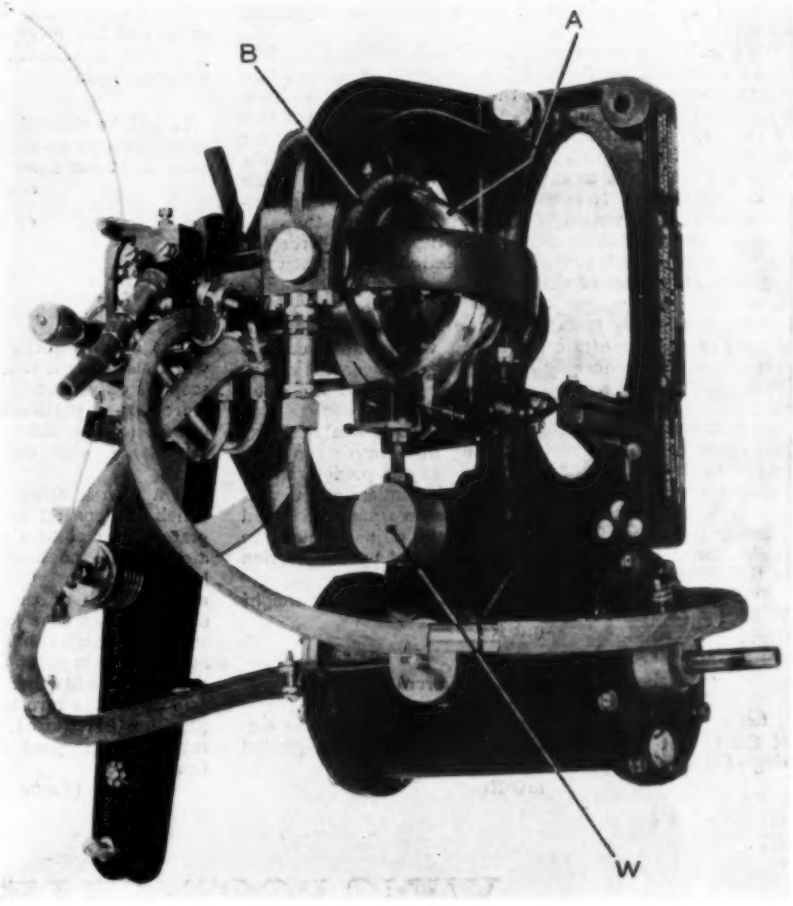


Fig. 2. The complete aileron unit, showing gyroscope assembly

In addition to the operation of the detector valve which results from the precession of the inner gimbal ring from its neutral position, the spring mechanism E is brought into operation by the relative displacement of the inner and outer gimbal rings, and exerts a small torque about the vertical axis of the inner ring in such a sense as to tend to restore the inner rings to its orthogonal position.

The effect of this small restoring torque is not, as might at first sight be supposed, to return the inner ring to its normal position at right angles to the outer ring, but to cause a small precession of the outer gimbal ring about its horizontal axis in such a direction as to return the weight W towards the vertical.

It will thus be seen that if the weight W is displaced from the vertical, it will gradually subside to the vertical in the manner described, and it therefore follows that the weight will not of itself tend to depart from the vertical.

It was stated in the above description that if the weight W is displaced from the vertical, the gravitational torque which it exerts on the outer gimbal ring causes an azimuth precession of the inner gimbal ring, thus causing the inner gimbal ring to depart from its normal position orthogonal to the outer ring. As was explained, the departure of the inner ring from the orthogonal position brings the detector valve, the precessing cylinder and the spring E into operation, but it is not self-evident how the inner ring is itself returned to the orthogonal position as and when the weight W again lies in the vertical. This may be briefly explained as follows:

The gravitational torque on the outer ring caused by a displacement of the weight W is not a constant torque, but varies with the sine of the angle of displacement. The counteracting torque of the precessing cylinder, however, is independent of the displacement angle, and at small angular displacements the torque of the precessing cylinder considerably exceeds the gravitational torque due to the weight. The excess torque about the horizontal axis of the outer gimbal ring results in a precession of the inner gimbal ring about its vertical axis, and the inner ring is thus gradually returned to its normal orthogonal position. When the two rings are again orthogonal the detector valve is closed and the precessing cylinder no longer operates.

Thus we see that in straight flight, at any rate, the gyroscopic system as represented by the gyroscope, the gimbal rings and the erecting gear illustrated in Fig. 1 does, in fact, always tend to erect towards the vertical. It remains to consider the behaviour of the system when in-

fluenced by the centripetal accelerations of curvilinear flight.

Now let it be supposed that the aircraft is turning steadily in an unbanked turn. It will be clear that, in addition to the gravitational force on the weight W, there is now a centrifugal force which must exert a torque about the axis of the outer gimbal ring. It has been shown earlier that the effect of a torque about the longitudinal axis of the outer gimbal ring is to cause an azimuth precession of the inner gimbal ring. In actual fact, the torque due to centrifugal force on the weight W causes a precession of the inner gimbal ring in the same direction as that in which the aircraft is turning, and, provided the relationship between the angular momentum of the gyroscope, the mass (or radius of action) of the weight W, and the forward speed of the aircraft is correctly maintained, the inner gimbal ring will precess at the same rate as that at which the aircraft is turning, and consequently no relative displacement of the inner gimbal ring will take place relatively to the outer ring.

It will be seen from the following simple analysis that precession of the inner gimbal ring in azimuth can only be identical with that of the aircraft at one predetermined forward speed, and it will therefore be understood that if a turn is maintained for an appreciable time at a speed differing from that for which the initial adjustments were made, then a small error will be introduced by the erection of the weight W away from the vertical.

During a turn, the centrifugal force acting on the weight W is

$$m\Omega^2R,$$

where m is the mass of the weight,
Ω is the rate of turn of the aircraft, and
R is the radius of the turn.

Let r represent the effective radius of action of the c.g. of the weight W. Then the torque on the outer gimbal ring of the gyroscope during a flat turn is

$$m\Omega^2Rr$$

Let $I\omega$ represent the angular momentum of the gyroscope and let θ represent the rate of precession of the gyroscope in azimuth due to the centrifugal force on the weight. Then

$$m\Omega^2Rr = I\omega\dot{\theta}$$

It will be clear that if the rate of turn of the aircraft is to be equal to the rate of precession of the gyroscope, i.e. if Ω is to be equal to θ, then

$$m\Omega Rr \text{ must equal } I\omega$$

$$\text{or } \Omega R \text{ must equal } \frac{I\omega}{mr}$$

$$\text{i.e. } V \text{ must equal } \frac{I\omega}{mr}$$

But $\frac{I\omega}{mr}$ is a constant, the value of which is determined by the initial adjustments of the control, and it will thus be seen that the rate of precession of the gyroscope is only exactly equal to the rate of turn of the aircraft at one particular forward speed. The mass of the weight (or its radius of action) is therefore adjusted in accordance with the normal cruising speed of the aircraft.

If a turn is carried out at a speed other than that for which the control has been adjusted, the weight W will gradually erect to a false datum with the result that the aircraft will no longer be controlled into an accurately level attitude. Unless the turn is maintained for an undue length of time, however, and at a speed widely differing from that for which the control has been tuned, the error which is introduced in the lateral level by a turn at an incorrect speed is scarcely appreciable. In any case, the weight will commence re-erection to the true vertical as soon as the turn is stopped. Except when the utmost precision is required, it is quite unnecessary to fly accurately at the speed for which the control has originally been tuned.

(To be concluded next month.)

WING-ROOT FILLETS

Obtaining the Venturi-tube Effect : A Method of Setting-out

By R. CAREY

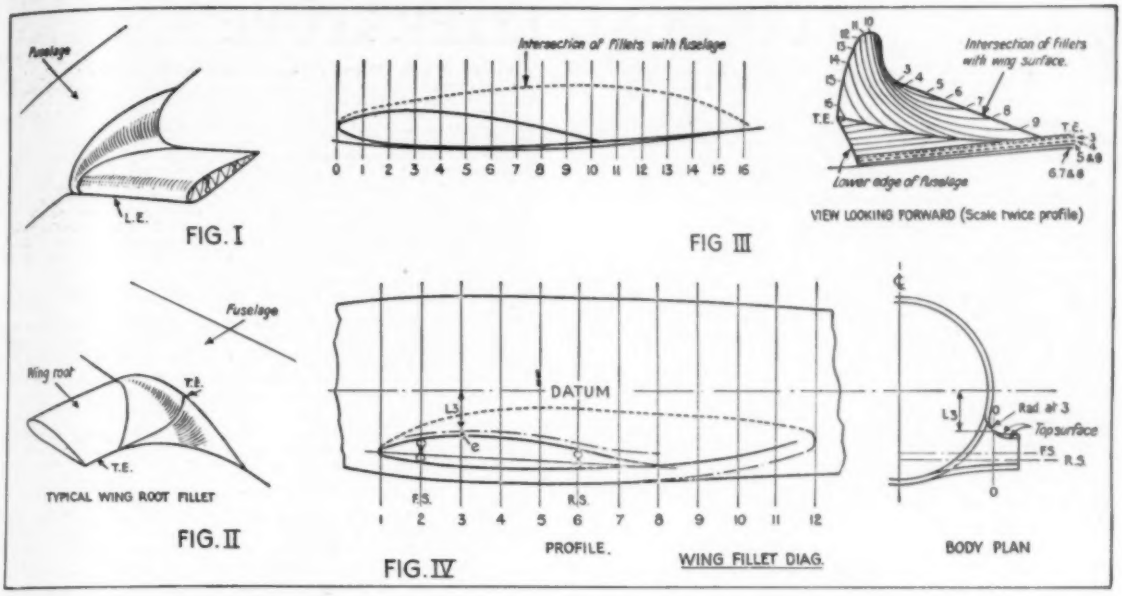
DURING the last few years in aircraft construction greater attention seems to have been given to cleaning up the external surfaces, hence reducing the unnecessary drag which they caused. The advent of the retractable undercarriage is, no doubt, the most outstanding attempt to reduce drag, and one is puzzled as to why it came so late in the evolution of the aeroplane. All the earlier publications on the study of flight of bodies heavier than air are based on observations of birds in various attitudes of flight, yet very little mention (if any) seems to have been made of the fact that a bird lifts its feet up to its body when flying. Admitted, there were greater problems to be solved in the early days of flying, but, nevertheless, one would expect to see the retractable undercarriage less of a novelty than it is at the present time.

The intersection with the fuselage of the bottom wing in a biplane and the main wing in a low-wing monoplane is another source of unwanted drag. The degree of drag can be aggravated or reduced by wing-root fillets, and it is the laying-out of these that the writer wishes to describe in this article.

It has been proved by various wind-tunnel tests, both in this country and America, that considerable interference is set up at the junction of the wing and fuselage. It has also been observed that, in addition to decreasing the aerodynamic efficiency, this interference causes a loss of longitudinal control and a violent buffeting of the tail due to eddying wake from the wing root. The failure of one low-wing monoplane was attributed to this tail buffeting set up by wing-root eddies.

It would appear from experiments that the detrimental effect is directly due to a premature breakdown of the flow of air at the wing fuselage intersection. The obvious solution is to delay this breakdown until it has passed wing and fuselage surfaces. Wing fillets are fitted with the object of guiding the air flowing round the body and wing surface into one channel with the minimum change of direction and pressure. From experiments in America on wing-nut fillets it has been observed that increasing the T.E. radius improves the maximum lift and prevents induced drag losses at medium-lift coefficient. Also, the fillet should taper as uniformly as possible from the L.E. to the T.E. It was also observed that with no fillets the air flow over the upper surface of the wing began to break down near the intersections of the wing and fuselage, and the turbulent region spread laterally as the angle of attack was increased, causing a premature stalling of the wing at the root. (Ref. 1.)

It has been suggested that the interference occurs when the air stream has to expand at more than the rate which allows it to remain in contact with the body and wing



surface. A certain rate of expansion can be tolerated, but if the surfaces diverge from one another too rapidly the flow of air detaches itself from them, and a region of turbulence is set up which leads to loss of lift and an increase of drag. Hence the surface of the wing-root fillets should conform to the cone of a venturi tube if the flow of air is to follow the surface without breaking away. (Ref. 2.)

On the underside of the wing the pressure gradient is of the opposite sign, and so will, to some extent, assist the flow of air to adhere to the surface. From certain experiments carried out at the N.P.L. a fillet of radius only one-sixteenth of the wing chord increased the lift by more than 100 per cent. and reduced the drag 20 per cent. This radius is assumed to be placed at the deepest section of the wing and to increase in radii towards the trailing edge (Ref. 3), and decrease towards the L.E.

In setting out a wing-root fillet one must lay out the standard wing profile for the centre section in its relative position to the datum of the machine, then proceed to mark off a number of stations from the L.E. of the wing to a distance beyond the T.E. (Fig. 4). Next proceed to draw in the half "body plan" and indicate the stations in section (these are circular in the illustration, for simplicity).

Having drawn in a few sections, project the centres of spars and indicate the top and bottom surface of the wing at deepest section (Station 3 in illustration). We can now draw in our radius equal to one-sixteenth chord, joining the top surface with the body at that section. The bottom surface is purely a matter of fairing-in, and depends on the vertical position of wing root intersection with body.

Proceeding, we draw a line intersecting the fillet at any given distance from the centre line of the machine as at "o.o." The number will depend on the scale and size of fillet, and, naturally, the larger number of intersections we make will add to the accuracy of our resultant shape. L_3 in Fig. 4 indicates the point of intersection of the vertical with the radius, and should be projected back on to the profile at Station 3. This point is indicated at "e." Measure the distance between the point "e" and the top surface of the wing at Station 3, and proceed to mark off this height at all other stations between the L.E. and T.E. of the wing. Draw a line through these points which will be parallel to the wing surface at a given height above it. Project these points back on to line "o-o" on the body plan, giving us a third point to draw our radii in for all stations between the L.E. and T.E.

We can now proceed to draw radii passing through these points and tangential to the body and top surface corresponding to each station, giving us a series of radii increasing towards the T.E. Reference to Fig. 2 will illustrate how the trailing edge is continued on into the body from Station 8 to 12 (Fig. 4), as obviously it would be impossible to stop the fillets abruptly at the T.E. of the wing as indicated by heavy line at T.E. (Fig. 2).

A plan view will have to be projected from the profile, and the wing T.E. proper carried on in a curve to meet the body and given a reflex curve in profile. The intersection of the reflex T.E. with the Stations 8 to 12 will have to be projected on to the body plan and faired into the body at each station. A typical example is shown in Fig. 3.

The main feature to bear in mind is that you are trying to fit a form of venturi tube at the junction of the wing with the body.

Ref. 1. Report No. 482, Wing-Fuselage Interference, etc. By J. A. White and M. J. Hood.
Ref. 2. Effect of Fillets on Wing-Fuselage Interference. By A. L. Kleen.
Ref. 3. Interference. By E. Ower. *Journal R.A.E.S.* Vol. XXXVI, July, 1932.

The Institute of Metals

The 27th annual general meeting of the Institute of Metals was held in London on March 6 and 7 last. Twelve papers were presented for discussion, of which two were of direct interest to aeronautical engineers. "Corrosion-Fatigue Properties of Duralumin with and without Protective Coatings" was the title of a paper presented by Mr. I. J. Gerard and Mr. H. Sutton, both of the Royal Aircraft Establishment, Farnborough. Tests were made in air and in salt-spray after protecting the surface in various ways. In air the untreated material gave a fatigue limit of stress of ± 9.1 tons per sq. in. at 10^7 cycles, and the anodized material ± 11.1 tons per sq. in. In a salt-spray lanolin coating and cadmium plating afforded little protection, but zinc plating gave a substantial improvement. The best results were obtained with a coating of synthetic resin varnish and stoving for 2 hours at 150 deg. C. Metal so treated gave a fatigue limit stress of ± 12.2 tons per sq. in. at 10^7 cycles.

"Alloys of Magnesium" was the title of a paper presented by Mr. W. E. Prytherch, of the N.P.L. It described investigations into the mechanical and rolling properties of some magnesium alloys. No magnesium alloys have yet been made with the satisfactory heat treatment characteristics of aluminium alloys.

TECHNICAL LITERATURE

THE AERO ENGINE

The Internal Combustion Engine. Vol. II, The Aero Engine, by D. R. Pye, Deputy Director of Scientific Research, Air Ministry, with a Chapter on The Aeroplane and its Power Plant by W. S. Farren. (Oxford University Press, 21s. net.)

AERONAUTICAL engineering has been aptly described as ordinary engineering made more difficult. The aero engine may, perhaps, be regarded as the athlete among internal-combustion engines, and in his latest book Mr. Pye sets out admirably the problems and difficulties which arise in the conditions peculiar to the aero engine. The book is a sequel to Mr. Pye's earlier volume, in which he dealt with the basic principles of combustion and thermal efficiency in all types of internal-combustion engines.

Mr. Pye has the very rare gift of being able to explain abstruse problems simply, and in the present book the reader appreciates this quality on almost every page. The author has taken for granted that the reader is familiar in a general way with the different types of aero engine, and all purely descriptive matter has been omitted. A knowledge of the outlines of a design is all that is required to follow the arguments set forth, but where some detail assumes particular importance it is dealt with in its proper place.

A Wider View

In order to enable the reader of the book to see the aero engine against its proper background, Mr. Pye has included a special chapter on "The Aeroplane and Its Power Plant." This has been written by Mr. W. S. Farren, and is a remarkably fine outline of the interaction between the characteristics of the two.

Mr. Pye devotes chapters to the following subjects: The limits of internal-combustion engine performance; Piston and valve temperatures; Lubrication and lubricants; The principles of heat transference from a solid to a fluid; The air-cooling of cylinders; Liquid cooling: Radiators; The fuel-air mixture supply; Carburetters; Superchargers; The two-stroke cycle; Analyses of complete engine performance; Altitude and power output; Fuel economy.

The book is of value to the student no less than to the designer, and is destined to become the standard text book on the subject of aero engine design. It is so written that it will not quickly become out of date, dealing as it does with principles rather than with specific ways of carrying these principles into effect.

SUMMARIES OF AERONAUTICAL RESEARCH COMMITTEE REPORTS

REPORTS published by His Majesty's Stationery Office, London, which may be purchased directly from H.M. Stationery Office at the following addresses: Adastral House, Kingsway, W.C.2; 120, George Street, Edinburgh; York Street, Manchester 1, St. Andrew's Crescent, Cardiff; 15, Donegall Square West, Belfast, or through any ordinary bookseller.

THE LANDING OF AEROPLANES. PART I. NOTE ON MODERN LANDING TECHNIQUE. By R. P. Alston, B.A. PART II. CHART SHOWING THE EFFECT ON THE LANDING RUNS OF DRAG/LIFT RATIO AND TOUCHING SPEED. STUDY OF THE EFFECTIVENESS OF HIGH LIFT AND AIR BRAKE DEVICES IN REDUCING LANDING RUNS. By L. W. Bryant, B.Sc., A.R.C.Sc., and I. M. W. Jones. R. & M. No. 1508. (16 pages and 18 diagrams.) November 26, 1932. Price 1s. 3d. net.

The progress in aeroplane design that has been made in recent years has brought with it a certain number of difficulties connected with landing. On the other hand, improved undercarriages and the addition of wheel brakes have done something towards mitigating the difficulties provided that the earlier technique of landing is modified to suit the new conditions. The mathematical aspect of flattening out and landing has been treated by Glauert in R. & M.666(1) and 667,(2) and by Meredith in R. & M.993(3), while the pilot's point of view has been treated by Hill in R. & M. 740(4). In all these papers complete flattening out has been assumed to be the ideal and the aeroplane has been supposed to touch down with zero vertical velocity when perfectly handled. If the incidence of the wings when the aeroplane is resting on the ground (which will be called the "ground incidence") is equal to the stalling incidence, then a perfect three point landing will be made at stalling speed and zero rate of descent. This type of landing, which one may call the "classical landing," has been taught by the C.F.S. and by civilian schools for many years, the type of aeroplane used for training being of a not very efficient type.

Aircraft are now used both in the R.A.F. and for civil use which are of lower drag than before and which lead the pilot into difficulties when he attempts to land them in the classical manner. In the present discussion an attempt is made to combine flying experience with a simplified theory of the motion in such a way as to assess the importance of various factors in design.

The process of landing is divided into four stages. (1) The initial straight glide, (2) flattening out so that when the path is horizontal the lift is equal to the weight, and wheels and tail skid are close to the ground, (3) floating horizontally with decreasing speed and increasing incidence until either ground incidence or stalling incidence is reached, whichever is the less, (4) three point landing, followed by ground run to rest. In an ideal landing (3) does not occur. If the ground incidence exceeds stalling angle the landing is inevitably heavy.

The general conclusions reached are that:—

(*a*) Ground angle in excess of stalling angle is the main cause of a heavy drop on landing.

(*b*) Tendency to float is mainly an effect of increased aerodynamic efficiency, and is independent of ground incidence. Given the tendency to float, the length of float increases as the ground incidence increases to stalling, if a perfect three point landing is attempted.

(*c*) Some form of air-brake is urgently necessary, in order that:—

(1) A greater precision of approach may be obtained.

(2) The least excess of speed which pilots are willing to undertake in the initial glide may be wholly lost in the flattening out.

(*d*) In the absence of air brakes it is best to arrange the ground incidence to correspond to the excess speed at the end of the flattening out, so as to take full advantage of the ground friction. An alternative method, with a robust undercarriage, when the ground incidence is less than stalling incidence, is to perform an incomplete flatten out at stalling, and end by gliding to the ground at a small angle.

In Part II the four stage landing theory of Part I is developed to form a ready basis of comparison of the characteristics of various aeroplanes. In order that the modern aircraft should be landed as easily as the older type some device is necessary which increases the maximum lift moderately and the drag-lift ratio considerably. A small plate (0.05 chord in depth) fitted normal to the under-surface of the wing and about one-tenth of the chord from the trailing edge, described as a Schrenk plate, fulfils these necessary conditions. The Zap flap may go a very great step farther, and the question then arises as to how far the pilot can make full use of the properties of the flap in view of the great rate of loss of height in the approach glide, and the difficulty of judging the correct height at which to commence flattening out. The spoiler employed as a small projecting plate normal to the upper surface towards the leading edge, and reinforced by powerful wheel brakes, is about equivalent in its effect on the total landing space to a Schrenk plate of about 0.5 chord in depth without the help of wheel brakes, when the total space is calculated from the clearing of a 100ft. obstacle on the edge of the aerodrome.

RESISTANCE OF CERTAIN STRUT FORMS. By R. Warden, Ph.D., M.Eng. of the Aerodynamics Department, N.P.L. R. & M. No. 1599. (31 pages and 11 diagrams.) March 20, 1934. Price 1s. 9d. net.

Information regarding the resistance of strut forms is requested periodically and the results of tests on a number of such forms have been collected to satisfy these demands. The results at minimum drag are given so that the relative merits of the various forms may be compared when used either as struts, wires or fairings. The largest differences in K_D between the various forms occur at the lowest Reynolds numbers. At a Vb/γ of 6.31×10^4 the minimum drag of the worst form, an elliptic form having a fineness ratio of 2.0, is about 500 per cent. greater than that of the best streamline form, whereas at a Vb/γ of 15.85×10^4 it is only about 80 per cent. greater. At a Vb/γ of 6.31×10^4 the minimum K_D of a lenticular form of fineness ratio 4.05 is less than 20 per cent. greater than that of the best streamline form. The results show the great advantage of using streamline, or even lenticular forms for wires.

On the evidence available the Gloster Chassis form having a fineness ratio of 3.29 and a minimum K_D of 0.0312 at a Bb/γ of 10×10^4 is the best for use as a fairing and the R.A.F.30 (mod.) of fineness ratio 4.0 is the best for struts and wires.

THE LIFT AND DRAG OF A WING SPANNING A FREE JET. By H. Glauert, F.R.S. Communicated by the Director of Scientific Research, Air Ministry. R. & M. No. 1603. (8 pages and 2 diagrams.) March 27, 1934. Price 6d. net.

It is intended to conduct experiments in the large wind tunnel on aeroplanes whose wings will project beyond the boundary of the free jet, and it would be useful to know the magnitude of the induced drag of a wing under these conditions.

Theoretical formulæ have been developed for calculating the distribution of lift across the span of a wing, which extends across a diameter of a free jet, and the corresponding induced drag. Numerical results have been derived from these formulæ for untwisted wings of constant chord.

The effective aspect ratio of a wing spanning a free jet is only slightly greater than one-half of the aspect ratio of the part of the wing in the jet. The theory provides a method of calculating the lift and drag of the wing, but it is based on the assumption of a sharp boundary of the jet and the results may need correction in practice to allow for the diffused nature of the boundary.

It is suggested that the theoretical formulæ developed in this report should be checked by a few special experiments.

THE BUCKLING OF A LINKED BEAM HAVING STRENGTH IN FLEXURE AND SHEAR. By R. A. Fairthorne, B.Sc. R. & M. No. 1616. (6 pages and 3 diagrams.) January 30, 1934. Price 6d. net.

The behaviour of a simple model beam, rigid in flexure but capable of shear, has already been investigated and the model has here been modified to include flexural, as well as shear, deflections.

The stability is considered of a linked beam under end load, first for flexure only and then for flexure and shear. It is shown that, if the flexural and shear strengths are properly defined, the formula $\frac{1}{P_1} = \frac{1}{P_f} + r$, relating to homogeneous beams, which gives the modified Euler buckling load P_1 in terms of the usual buckling load P_f and the shear constant r, applies also to a lattice beam.

It is suggested that the method may be of use in obtaining, by an arithmetical process, reasonable approximations to the buckling loads of homogeneous struts of variable cross section.

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(1) R. & M.666. "The Landing of Aeroplanes." Part I. Glauert.
(2) R. & M.667. "The Landing of Aeroplanes." Part II. Glauert.
(3) R. & M.993. "Note on the minimum speed from which the direction of a gliding aeroplane can be changed to a horizontal path for landing." Meredith.
(4) R. & M.740. "The Manœuvres of Getting Off and Landing." Hill.

CORRESPONDENCE

The Editor does not hold himself responsible for the opinions expressed by correspondents. The names and addresses of the writers, not necessarily for publication, must in all cases accompany letters intended for publication in these columns.

ROTATING-WING FLIGHT

[3027] Your issue of March 21 must surely be considered as a "red-letter" issue in so far as the articles relating to further developments with direct-lift aircraft are concerned. Experiments with this type of craft seem definitely to be exploring an avenue in which lies much material which, we hope, will prove to be of extreme value in the future. One can foresee a new demand for aircraft being created on the appearance of the practical machine that will do all expected of the orthodox aeroplane with the added tremendous advantages of the types now being experimented with. Undoubtedly the majority of readers of *Flight* will await with interest and eagerness the results of flying tests of both the Asboth machine and the improved "direct-start" Autogiro.

Might I suggest that, if it could possibly be arranged, a demonstration of both these types at the Royal Air Force Display in June would have, as was shown by the demonstration of the Autogiro last year, a most impressive effect?

Sutton. A. HENRY BARBER.

"NEXT TO NOTHING"

[3028] While reading your singularly interesting article on stratospheric flying I was struck by one remark in particular. You say that ". . . the average passenger would not be expected to stand such heights and, in fact, it seems doubtful whether a height above 8,000-10,000 ft. will ever be commonly used unless airtight cabins are introduced." Surely this exaggerates the effect of height? Long before I had become accustomed to flying, and before I had even learnt to fly, I was flown at 10,000 ft. without noticing anything more exciting than a pleasant sense of aloofness. I understand that 15,000 ft. is a common cruising altitude on American trans-continental flights, while crossing the Rockies—or even at other points—and the Douglas D.C.2 in its American form is designed to operate at such altitudes. Of course, on one special record run, when even a greater operating height was maintained, the passengers were fed with oxygen, but I should say that 12,000-16,000 ft. would be a safer estimate of the maximum unassisted commercial altitude.

Bedford. A. TRERIZE.

RUDDERLESS

[3029] In your "Outlook" paragraphs relating to control simplification and to the necessity for the rudder in present aircraft design no mention is made of the best-known type, in which all control in the air is obtained through a single column control. I refer to the direct-control Autogiro.

Although I hope, in the near future, to have an opportunity of learning to fly this interesting machine, my experience is at present confined to a mere half-hour's dual instruction. After some ninety-odd hours on conventional light aircraft, I can say that the principle of using the stick alone to turn and come out of a turn proved to be a perfectly natural one. Only while coming in to land had I the least desire to place my feet on the abortive rudder bar. Those ninety hours, at least, had not made me "foot conscious."

Actually, in normal flying, one notices the rudder only while keeping a machine straight in the take-off, while holding up the nose in a vertical turn and while sideslipping or "crabbing" to lose height and speed before entering an aerodrome. My only complaint as far as the Autogiro was concerned is simply that there is no real "feel" in the control, but this, I was given to understand, is largely due to the heaviness of the control from the front seat. Anyway, the man-in-the-street does not want to be bothered with "feel" but would much rather be told that this or that movement produces this or that effect. TITUS OATES.

London, S.W.3.

R.A.F. RUGBY VICTORY

Army Beaten in the Services Rugby Tournament

IT is not easy to remember off-hand when the R.A.F. last won a match in the Services Rugby Tournament, but it has become an accepted tradition that in the last of the three matches the R.A.F. XV. should surpass its previous form and should give even the most powerful of Army sides a fright.

Some day, the critics suggested, this fright would be converted into an Air Force victory, and on Saturday last this actually came about, for the R.A.F. beat the Army at Twickenham by one penalty goal and one try (six points) to one try (three points).

It is certainly a fact that in this season the R.A.F. have had a better side than they have been able to muster for several years past. On paper they were not equal to the Army, whose outsides were mostly of international or of trial class, even though Cowey was not able to play. In the tight scrums too, the Army forwards (though Kendrew was not playing) were superior, and more often than not got the ball out to their outsides. The weather, however, was against the Army. It was a nasty, drizzly day, and the wet ball put the Army passing completely out of joint. The R.A.F. played to the weather. The whole side was tremendously fit, and they played a rushing game and kept it up to the end. In the loose the R.A.F. forwards had the best of matters, and the outsides found that kicking ahead and following up hard was the game which paid best.

There was only one resource left to the Army, namely, individual runs by their international three-quarters. Novis of England, Crawford of Scotland, and Unwin tried again and again to break through, but their most brilliant runs ended up either with dropped passes or with grim tackles by an insuperable Air Force defence. Probably the Army suffered by starting with Novis on the wing and Unwin in the centre. They changed over afterwards, but too late to win the match for the Army.

Within the first three minutes of play the Army were penalised for holding, and Irens kicked a penalty goal for the Air Force. Later in the first half Ashton was tackled with the ball, and as a result Novis dribbled on, picked up, and scored too far out for a goal to be kicked. The sides crossed over with the score at three points all. Towards the end of the second half an Army pass from a scrum was dropped, and G. A. Walker, who played a brilliant game throughout, kicked over the line and won the race for the touch down. Irens could not convert this time, though his kick was a good one.

The teams were:—

ARMY.—Lt. S. T. A. Radcliffe (R.E.); Lt. A. L. Novis (Leicestershire Regt.), Lt. E. J. Unwin (Middlesex Regt.), Lt. F. W. Simpson (R.E.), and Lt. J. A. Crawford (R.E.); Lt. J. R. Cole (Loyal Regt.) and Lt. G. J. Dean (R. Tank Corps); Sgt. A. Boast (Welsh Guards), Gdsmn. I. Wilcox (Welsh Guards), L.-Cpl. F. W. Whitcombe (R.E.), Lt. K. J. McIntyre (R. Tank Corps), Lt. A. J. A. Watson (Queen's R. Regt.), Lt. P. G. Hobbs (Royal Artillery), Rev. V. J. Pike (R. Army Chaplains), and Lt. H. J. Savers (Royal Artillery).

ROYAL AIR FORCE.—P/O. P. W. Ashton (Manston); L. A/C. W. R. Morgan (Worthy Down), P/O. W. C. A. Church (Sealand), P/O. S. G. Walker (Cranwell), and P/O. J. M. Thompson (North Weald); P/O. G. A. Walker (Sealand) and P/O J. L. Barker (Catterick); Sgt. J. S. Bignal (Duxford), L. A/C. W. V. Reynolds (Henlow), P/O. R. H. Waterhouse (Donibristle), Flt. Lt. C. E. St. J. Beamish (Digby), P/O. H. J. Irens (Sealand), L. A/C. W. Gascoigne (Boscombe Down), F/O. J. S. Wilson (Halton), and L. A/C. J. Holland (Upper Heyford).

Referee Mr. F. W. Haslett (Ireland).

NEXT WEEK

Next week's issue of *Flight* will be a special Airports Number, dealing very fully with modern airport equipment, construction and organisation, both at home and abroad

THURSDAY FLIGHT APRIL 4

THE ROYAL AIR FORCE

SERVICE NOTES AND NEWS *AIR MINISTRY ANNOUNCEMENTS*

MILITARISED: The "Dragon Rapide" ordered for No. 24 (Communications) Squadron at Hendon. (*Flight* photograph.)

FAST TRANSPORT FOR THE AIR COUNCIL

The D.H. "Dragon Rapide" (two "Gipsy VI" engines), ordered by the Air Ministry for the use of the Air Council, has now been delivered. Apart from the Service marking, the "Rapide" is, to outward view, quite standard. Several special features of equipment have, however, been ordered. A Harley landing light, with a dipping mechanism controllable from the pilot's seat, is mounted in the nose and a signalling lamp is fitted beneath the fuselage. There is a second emergency exit in the forward part of the cabin and a rip panel in the cockpit for easy egress with parachutes. Behind the pilot's bulkhead is a Marconi receiving and transmitting set, operated either by the pilot himself or by an operator; a dual-purpose generator supplies current for both lighting and radio.

R.A.F. FLYING ACCIDENTS

The Air Ministry regrets to announce that F/O. George Edward Bullen Nixon and A.P/O. Colin Kirkley, the pilot and passenger of the aircraft, lost their lives in an accident which occurred near Scopwick, Lincolnshire, on March 18, 1935, to a "Tutor" aircraft of No. 2 Flying Training School, Digby, Lincolnshire.

The Air Ministry regrets to announce that F/O. Archibald Mouritz Doran lost his life at Eastchurch as the result of falling from a "Wapiti" aircraft of the Air Armament School, Eastchurch, on March 21, 1935. F/O. Doran was the passenger of the aircraft.

At the inquest on Friday last, when a verdict of accidental death was returned, F/O. E. C. Ingham, the pilot of the machine, said it was laid down to be the pilot's duty to ascertain if the passenger had the safety wire attached before taking off. He asked Doran whether he was ready to take off, and he replied that he was. During a gliding turn at 500 to 700 feet he heard a thump and thought Doran had fallen into the bottom of the cockpit. He looked into the cockpit and could not see him, but saw two pieces of cowling falling. On landing he found the bombing platform open. His theory was that Doran had finished his second film and leaned back against the back part of the gun ring. "That would make his feet tend to slide forward, and his full weight would be tending to push the platform forward," he said. "I suggest that that weight suddenly shot the platform forward. The natural thing to do when that happened would be to step back. I think he did this and fell out."

THE R.A.F. BENEVOLENT FUND

Meeting of Council, March 13, 1935

The first Council Meeting of the year 1935 was held at the offices of the Fund, No. 7 Iddesleigh House, Caxton Street, London, S.W.1, at 2.30 p.m., on Wednesday, March 13, 1935. The Viscount Wakefield, of Hythe, was in the chair. The auditors' accounts for the year 1934 were approved by the Council. In his report the Honorary Treasurer, Mr. W. S. Field, recorded that gross expenditure on relief totalled £16,190, an amount only slightly less than the peak year 1933. It is evident that in spite of improving trade conditions applications for assistance are increasing at a rate, and in measure peculiar to the Service that trains as well as fights in the air. Happily, however, donations during 1934 were appreciably higher than in 1933, and it had been possible to resume the normal policy of providing assistance on a generous scale, and the year had finished with a credit balance. The Honorary Treasurer pointed out, however, that of the total income less than one half was derived from dividends. As long as the Fund is so dependent upon sources which are liable to be affected by economic conditions, and which may even be withdrawn altogether in time of a national emergency, the urge to secure bigger dividends by increased capital will persist. Funds must therefore be built up, and this must be done without any departure from the policy of giving generously in all deserving cases. The Council have confirmed the formation of a special Contingencies Fund to be drawn upon in emergency.

The usual financial resolutions concerning the first quarter of the year were then carried. The Council were informed that grants to the amount of £3,492 12s. 9d. had been disbursed since the last meeting on December 5, 1934, and that 542 applications had been dealt with. Although the number of applications dealt with was slightly less than for the same period in the preceding year, the expenditure on grants was the greatest recorded in the history of the Fund. Donations had been received amounting to £1,231 9s. 7d., representing an increase of approximately £660 over the same period last year. The increase is due mainly to a legacy of £300 left by Major-General C. M. Ross-Johnson, and the lecture given by Mr. C. W. A. Scott at the Queen's Hall on February 7, 1935, resulting in a donation to this Fund of £251 13s. 1d. Members of Council heartily supported Dame Helen Gwynne-Vaughan in a vote of thanks to Lord Wakefield.

No. 4 FLYING TRAINING SCHOOL

The undermentioned officers and airman pilots have been awarded special assessments as shown hereunder on completion of a course of *ab initio* flying training at No. 4 Flying Training School:—

Special Distinction

A.P/O. J. D. T. Revell.

Distinguished Pass

A.P/O. G. A. Richmond, 562411 L.A/C. Ashfield, G., 366462 L.A/C. Stansbury, G. E., and 561914 L.A/C. Steere, J.

THE SINGAPORE GARRISON

In view of the provision in the Air Estimates for increased accommodation at Singapore, it may be stated that a second flying boat squadron will be added to the garrison there.

AN AUTOGIRO FOR THE FLEET

The Fleet Air Arm will shortly take delivery of an Autogiro, which will probably be attached to the carrier *Courageous*. There its possibilities for naval work will be tried out, but it would appear that the Autogiro is specially suitable for work with cruisers and capital ships.

ROYAL AIR FORCE GAZETTE

London Gazette, March 19, 1935

General Duties Branch

F/O. D. M. T. Macdonald is granted a permanent commission in this rank (March 14).

The following Pilot Officers are promoted to the rank of Flying Officer:—R. H. Young (Feb. 12), G. J. Grindell (March 2), H. J. F. Le Good (March 12).

Lt. Cdr. A. A. Murray, R.N., Flight Lieutenant R.A.F., ceases to be attached to the R.A.F. on return to Naval duty (March 1). Group Capt. V. O. Rees, O.B.E., is placed on the half-pay list, scale A (March 15). Sqn. Ldr. C. St. Noble is placed on the retired list (March 19).

The following Flying Officers are transferred to the Reserve, class A (March 14):—W. E. L. Lewis, N. Daunt.

F/O. D. A. Cameron relinquishes his short service commission on transfer to the Royal Australian Air Force Reserve (March 18).

Medical Branch

Flt. Lt. T. C. Macdonald, M.B., Ch.B., is granted a permanent commission in this rank (March 20).

ROYAL AIR FORCE RESERVE

Reserve of Air Force Officers
General Duties Branch

G. B. Holmes is granted a commission as Flt. Lt. in class C (March 6). D. O. Young is granted a commission as Pilot Officer in class A (Jan. 5).

The following Pilot Officers on probation are confirmed in rank:—W. L. Stranger (Feb. 8), R. J. Falk (Feb. 9), R. W. G. Kitley (Feb. 22).

F/O. E. C. A. Wing is transferred to class C (Feb. 4). F/O. A. M. West relinquishes his commission on completion of service (June 30).

SPECIAL RESERVE

General Duties Branch

P/O. David Oswald Young resigns his commission (Jan. 5).

AUXILIARY AIR FORCE

General Duties Branch

No. 604 (COUNTY OF MIDDLESEX) (FIGHTER) SQUADRON.—F/O. R. Smallman-Tew resigns his commission (Sept. 21, 1934).

ROYAL AIR FORCE INTELLIGENCE

Appointments.—The following appointments in the Royal Air Force are notified:—

General Duties Branch

Group Captains.—W. C. Hicks, A.F.C., to R.A.F. Base, Gosport, 5.3.35; to command vice Group Capt. J. H. S. Tyssen, M.C. J. McCrae, M.B.E., to Home Aircraft Depot, Henlow, 15.3.35; to command vice Group Capt. V. O. Rees, O.B.E.

Wing Commander.—H. G. Smart, O.B.E., D.F.C., A.F.C., to Central Flying School, Wittering, 7.3.35; to command vice Group Capt. P. C. Maltby, D.S.O., A.F.C.

Squadron Leaders.—J. Blackford, to School of Army Co-operation, Old Sarum, 11.3.35; for flying duties vice Sqn. Ldr. G. O. Venn. H. V. Pendavis, D.S.A., to No. 22 Group Headquarters, S. Farnborough, 5.3.35; for photographic duties. W. R. Cox, M.C., A.F.C., to No. 1 Armament Training Camp, Catfoss, 24.2.35; for armament duties. F. J. Fogarty, D.F.C., A.F.C., to No. 84 (B) Squadron, Shaibah, Iraq, 21.2.35; to command vice Sqn. Ldr. S. F. Vincent, A.F.C. R. S. Sugden, A.F.C., to No. 1 Armoured Car Co., Hinaidi, Iraq, 19.2.35; to command vice Group Capt. W. V. Strugnell, M.C. G. S. Oddie, D.F.C., A.F.C., to No. 23 Group Headquarters, Grantham, 15.3.35; for Personnel Staff duties.

Flight Lieutenants.—H. H. Brookes, to Special Duty List, 9.3.35; for duty with the Army, on appointment as G.S.O. III Scottish Command. C. K. J. Cogle, to Station Headquarters, Kenley, 5.3.35. J. W. Lissett, to No. 142 (B) Squadron, Andover, 4.3.35. G. T. H. Pack, to School of Technical Training, Manston, 11.3.35. H. L. Patch, to No. 12 (B) Squadron, Andover, 5.3.35. A. J. Warwick, to Headquarters, Fighting Area, Uxbridge, 6.3.35. P. de C. Festing Smith, to No. 3 Armament Training Camp, Sutton Bridge, 20.2.35. P. W. Lowe-Holmes, to No. 3 Armament Training Camp, Sutton Bridge, 21.2.35. D. B. McGill, to No. 1 Armament Training Camp, Catfoss, 28.2.35. B. Paddon, to No. 2 Armament Training Camp, North Coates Fitties, 10.2.35. H. M. Pearson, to Special Duty List, 14.3.35; on being seconded for duty with the Peruvian Government. E. A. Jones, to No. 203 (F.B.) Squadron, Basrah, Iraq, 9.3.35. W. A. Opie, to No. 5 (Army Co-operation) Squadron, Quetta, India, 14.3.35

Flying Officers.—E. S. D. Drury, to Air Armament School, Eastchurch, 4.3.35. W. W. E. Oliver, to No. 503 (Co. of Lincoln) (B) Squadron, Waddington, 4.3.35. A. R. Collins, to No. 1 Armament Training Camp, Catfoss, 28.2.35. R. B. Dashper, to No. 2 Armament Training Camp, North Coates Fitties, 17.2.35. W. F. C. Hobson, to No. 3 Armament Training Camp, Sutton Bridge, 28.2.35. E. M. Lewis, to No. 2 Armament Training Camp, North Coates Fitties, 25.2.35. J. R. Palmer, to No. 1 Armament Training Camp, Catfoss, 28.2.35. C. W. Williams, to No. 3 Armament Training Camp, Sutton Bridge, 20.2.35. J. B. Altham, to No. 2 Flying Training School, Digby, 11.3.35. C. E. J. Baines, to Royal Air Force, College, Cranwell, 11.3.35. J. A. S. Brown, to Station Flight, Abingdon, 11.3.35. K. B. B. Cross, to No. 5 Flying Training School, Sealand, 11.3.35. R. C. H. Crosthwaite, to R.A.F. Base, Leuchars, 11.3.35. W. R. Farley, to No. 2 Flying Training School, Digby, 11.3.35. R. C. Gaskell, to No. 2 Flying Training School, Digby, 11.3.35. W. E. Hooper, to No. 2 Flying Training School, Digby, 11.3.35. L. J. Neale, to No. 5 Flying Training School, Sealand, 11.3.35. W. E. Rankin, to No. 3 Flying Training School, Grantham, 11.3.35. G. N. Snarey, A.F.C., to No. 3 Flying Training School, Grantham, 11.3.35. G. D. Stephenson, to Royal Air Force College, Cranwell, 11.3.35. F. S. Wakeham, to No. 5 Flying Training School, Sealand, 11.3.35. J. N. Baxter, to No. 1 Armament Training Camp, Catfoss, 4.3.35. G. W. P. Grant, to R.A.F. Base, Gosport, 14.3.35. P. B. Wood, to No. 28 (Army Co-operation) Squadron, Ambala, India, 14.3.35.

Pilot Officers.—J. O. Carter, to No. 3 Armament Training Camp, Sutton Bridge, 21.2.35. J. J. McCarthy, to No. 9 ((B) Squadron, Boscombe Down, 26.2.35. A. Ross, to No. 40 (B) Squadron, Abingdon, 5.3.35. B. K. Burnett, to No. 18 (B) Squadron, Upper Heyford, 2.3.35. F. G. Frow, to No. 25 (F) Squadron, Hawkinge, 2.3.35. J. O. Hinks, to No. 13 (Army Co-operation) Squadron, Netheravon, 2.3.35. J. G. MacIntyre, to No. 57 (B) Squadron, Upper Heyford, 2.3.35. R. A. E. Traill, to No. 32 (F) Squadron, Biggin Hill, 2.3.35. The following Pilot Officers are posted to Royal Air Force College, Cranwell, on 28.2.35, on appointment to Permanent Commissions:—R. A. I. Harrison, E. A. Howell, J. P. Sloan. H. V. Alloway, to No. 5 (Army Co-operation) Squadron, Quetta, India, 14.3.35. J. W. Buchanan, to No. 11 (B) Squadron, Risalpur, India, 14.3.35. P. B. H. Butler, to No. 27 (B) Squadron, Kohat, India, 14.3.35. W. G. Devas, to No. 39 (B) Squadron, Risalpur, India, 14.3.35. J. E. Kirk, to No. 5 (Army Co-operation) Squadron, Quetta, India, 14.3.35. C. R. Paylor, to No. 5 (Army Co-operation) Squadron, Quetta, India, 14.3.35. D. G. H. Spencer, to No. 5 (Army Co-operation) Squadron, Quetta, India, 14.3.35. J. B. P. Thomas, to No. 60 (B) Squadron, Kohat, India, 14.3.35. E. L. A. Walter, to No. 39 (B) Squadron, Risalpur, India, 14.3.35.

Acting Pilot Officer.—D. C. Torrens, to No. 55 (B) Squadron, Hinaidi, Iraq, 19.2.35.

Stores Branch

Squadron Leader.—C. H. Pownall, to No. 1 Aircraft Storage Unit, Peterborough, 28.2.35, to command vice Sqn. Ldr. A. J. M. Ross, M.B.E.

Flying Officers.—E. N. Lowe, to No. 31 (Army Co-operation) Squadran, Quetta, India, 16.2.35. E. N. A. Crowe-Browne, to R.A.F. Base, Singapore, 15.3.35.

Accountant Branch

Wing Commander.—P. J. Wiseman, to R.A.F. Depot, Uxbridge, 8.3.35; for accountant duties.

Medical Branch

Wing Commander.—D'A. Power, M.C., to D.M.S., Dept. of A.M.P., Air Ministry, 14.3.35; for Medical Staff duties vice Group Capt. A. Grant, M.B.E.

Squadron Leaders.—G. P. O'Connell, to R.A.F. General Hospital, Palestine and Transjordan, 13.2.35; for duty as Medical Officer. F. L. White, to D.M.S., Dept. of A.M.P., Air Ministry, 6.3.35; for Medical Staff duties vice Wing Cdr. D. McLaren.

Flight Lieutenants.—F. H. Peterson, to R.A.F. General Hospital, Palestine and Transjordan, 13.2.35. A. S. Burns, to No. 99 (B) Squadron, Mildenhall 15.3.35. M. T. O'Reilly, to Station Headquarters, Worthy Down, 15.3.53.

Flying Officer.—H. F. Harvey, to No. 2 (Indian) Wing Station, Risalpur, India, 14.3.35.

PRIVATE FLYING

Australia's Aerodromes

LORD SEMPILL DISCUSSES THE PROGRESS THAT HAS BEEN MADE IN THE COMMONWEALTH

ALTHOUGH when I started out on my Australian flight, Melbourne was my main objective and attending the Centenary Celebrations the chief purpose in view, I intended, as a representative of the Royal Empire Society and The London Chamber of Commerce, to visit as many of the chief centres as possible. The itinerary to be covered, as I proposed to make a complete circuit of the Continent as well as to visit New Guinea, Tasmania and certain towns in the interior, involved practically a third of the total mileage to be covered by air on the round trip. By any means other than by air such a journey as contemplated would have been a wearisome and lengthy programme.

Value of the Aeroplane

HAVING at my disposal a reliable light aeroplane, the route traversed—which included long stretches where there is no organised transport—proved relatively easy and comfortable. The potentiality of aviation, which has been brought home to millions in a spectacular way by such outstanding events as the long distance flights of Scott, Kingsford-Smith, Mollison, Butler and others, between Australia and the Mother Country, is forcibly emphasised to the individual who is fortunate enough to be able to cover day after day interesting tracts of country which could hardly be reached by other means. Apart from the advantage conferred to the inhabitants of Australia by the increasing facilities placed at their disposal by the organised air transport system, the light aeroplane opens up a new era to many faced by the necessity of travelling long distances where surface travel, where possible at all, is a tedious business.

The problem of providing adequate ground organisation, which has always to be solved before aviation can make essential progress, is one on which those responsible for the development of flying in Australia are constantly engaged. The general policy pursued in certain European countries of encouraging local authorities to provide the necessary sites for use as landing grounds has been followed in Australia with encouraging results. While the Government has assumed responsibility for the provision of aerodromes and emergency landing grounds on approved routes over which the regular air services operate, it has taken the attitude that local governing bodies who are desirous of encouraging the flow of air traffic in their particular districts should be prepared to make available the necessary ground facilities.

Inspection of Sites

EVERY assistance possible is given by the Department of Civil Aviation towards this end. and the services of Departmental technical officers are made available without charge to advise on the steps to be taken to prepare such sites, with a view to bringing them up to the standard required for the issue of aerodrome licences. A number of inspectors of aerodromes are regularly engaged in travelling throughout the various states of the Commonwealth with the object not only of inspecting such sites as are already contemplated, but of pointing out the desirability of supplying ground facilities to such authorities as have not already taken an interest.

The result of this policy has been shown in the increasing number of aerodromes licensed, which has risen from fourteen municipal and public aerodromes and landing grounds at the end of 1928 to 124 at the end of 1933. In addition, at the same date there were over 200 landing grounds which had been acquired or leased by the Commonwealth Government and prepared for civil aviation purposes. These are also regularly inspected by travelling inspectors and maintained at Government expense.

A good deal has been effected in the last year or two to improve facilities, particularly at the chief State aerodromes, but a great deal remains to be done before they are brought up to the highest standard of modern requirements. In certain cases the original site selected has not always been the best available. For instance, the Air Port of Melbourne (Essendon), like so many others serving large towns in various parts of the world, is too far away from the city. Although described as suitable for all types of aircraft, it has been subjected to criticism in many quarters. It certainly suffers from a serious defect by reason of the position of wireless masts and high-tension wires in the vicinity, and a good deal of the original landing area is taken up at one end by a reservoir which, I understand, has been constructed since the aerodrome was laid down. Although plans are in hand for enlarging this aerodrome and extending the facilities at Essendon, there are many of the opinion that an alternative site known as Fisherman's Bend should be developed as the main air port of Melbourne.

An Alternative Aerodrome

FROM my observation of this area, which is situated close to the city, there would appear to be no doubt of its advantage over the present aerodrome. There is a large surface with unrestricted approaches, and being near the sea and the River Yarra it would provide excellent facilities for both land and seaplanes. It would no doubt involve considerable cost, but in the rapidly developing stage of aviation an important city such as Melbourne can hardly afford to neglect the opportunity of utilising a site which has so many obvious advantages.

Before continuing my tour of the continent, I had a busy ten days in Melbourne, where I had the privilege of conversations with His Excellency the Governor, Lord Huntingfield, the Lord Mayor and many prominent men in official and commercial circles. The visit of H.R.H. The Duke of Gloucester, representing His Majesty The King, had set the seal on the great Centenary Celebrations. Since his illustrious father, then Duke of York, visited Australia thirty years ago to open the Commonwealth Parliament, great progress has been made in the life of the State of Victoria. In no part of the Empire have these Royal visits been greater appreciated than by the Australian people. The presence of His Royal Highness at this hundredth anniversary has done much to make it a success, and has served to draw closer the bonds of unity which tie this great self-governing Dominion to the Mother Country. The population of Australia, who are very proud of their British ancestry, although less in number than the inhabitants of Greater London, comprise the largest aggregation of purely British stock to be found outside the British Isles. When the vast extent of the Continent is realised, the possibilities of the development which lies before it can be visualised.

Private Flying

FROM THE CLUBS

Events and Activity at the Clubs and Schools

MORECAMBE

The Lancaster, Morecambe and District Aero Club has received a licence and will start instruction on April 7. For the time being Airwork, Ltd., of Manchester, are to do the instructional flying for the club.

HATFIELD

Messrs. C. A. MacDonald and V. G. Parker have completed night flights for their "B" licences with the London Aeroplane Club, and Messrs. W. C. Ross and R. P. J. Leborgne have started a course of blind flying. During the past fortnight there have been seven new members: Messrs. D. W. Sutton, J. E. Thennison, D. E. Henderson, R. P. J. Leborgne, J. W. R. M. S. Trelawny and W. C. Ross.

Flying time for last week amounted to 63 hr. 5 min., and that for the previous week was 48 hr. 5 min.

Flying by the Royal Air Force Flying Club has been somewhat curtailed because one of the machines is undergoing its C. of A. overhaul. New members were Flt. Lt. C. B. R. Pelly, Flt. Lt. J. C. Cunningham, and F/O. R. Grant-Ferris.

BROOKLANDS

Capt. Davis is on holiday, Mr. Douglas is away, and Capt. Mackenzie has been successfully operated on for appendicitis, so that during the fine weather Capt. Findlay has been kept busy instructing, apart from his duties as sales manager. Flying hours amounted to fifty. Another machine has been added to the school fleet of five aircraft.

Reviewing the activities of the last year, the Brooklands Flying Club has every reason to congratulate itself. With a membership of 550 it achieved, along with its associated concerns at Lympne and Northampton, the satisfactory result of some 5,000 flying hours and passed approximately 140 pupils for "A" and "B" licences—thereby establishing records in the history of the club.

The lecture room, which was opened during the period, has proved, by its popularity, that the more technical side of aviation is rapidly establishing itself in the interests of civilian pilots.

The training of students at the Aeronautical College progressed briskly and many obtained ground engineer's licences through the medium of the instruction they had received at Brooklands.

LANCASHIRE

During the past month Messrs. G. P. Moss and T. Hooson and Miss M. Barnard have obtained instrument flying certificates, and Mr. L. P. Rowley has passed the test for instructional endorsement of his "B" licence. Messrs. Beverley and Pinckney carried out exemplary first solo flights, and the first-named has obtained his certificate

The date for the annual ball, to be held, as before, at the Midland Hotel, has now been fixed for Friday, November 22.

NORFOLK AND NORWICH

A fair portion of last week's flying was devoted to trial flying lessons, and Mr. Frank Hill has become a flying pupil.

The Lord and Lady Mayoress of Norwich, the president, and Lt. Cathcart-Jones will be present at the annual dinner, to be held at the clubhouse on Friday.

The club has recently produced a most interesting and well-illustrated prospectus dealing with the Public School Aviation Camp, which will be held again at Mousehold for the five weeks following August 6.

SOUTHEND

The days of the old aerodrome at Rochford are numbered. Quite recently the clubhouse was sold and the hand of the builder is obliterating all traces of a once popular aerodrome. The new municipal airport to which the Southend Club is moving is situated on the west of Warners Bridge on the Rochford road. There is an excellent service of buses, which do the trip in ten minutes from the centre of the town. Two new roads are being constructed, which will provide easy access from all parts of the town.

On March 25 the Southend Flying Club and Southend-on-Sea Flying Services, Ltd. (who, in conjunction with Short Bros., run the Rochester-Southend air ferry) took possession of their new premises, described in *Flight* of February 21, comprising a combined clubhouse and hangar.

Bad weather has held up the surfacing of the aerodrome which, when complete, will measure approximately 1,200 by 1,000 yards. At present the landing area is confined to a space roughly 450 yards square at the northern end.

For visitors by air the aerodrome and buildings are conspicuous, being bordered on the west side by the L.N.E.R. It is hoped that some time a railway station will be erected.

AT REDHILL: An aerial view of British Air Transport's new school aerodrome, showing clearly the present limits of the landing area and the good approaches. The clubhouse and the hangar can be seen in the left foreground. In due course both the "peninsular" and the "island" will disappear and the aerodrome will have a maximum run of 1,100 yards. (*Flight* photograph.)

Private Flying

WITNEY AND OXFORD
Miss Jean Morton has the distinction of being the club's first lady soloist. Flying times for the past week were 6 hr. 50 min. dual, and 13 hr. 30 min. solo.

KENT
Eighteen hours were flown during the past week, during which high winds stopped flying on three days. New members joined—Messrs. Stainton and Gray—and Mr. Klein made a first solo. Mr. Ramsay has taken delivery of a new "Hawk Major." F/O. E. Coleman has joined the instructional staff.

CAMBRIDGE
Several ambitious cross-country flights were made by members during the week. On Sunday nine members of the C.A.S.C. flew, but there were no new soloists among them. Mr. Sandford, Mr. Runciman and Mr. D'Orey made first solos. Flying time amounted to 47 hr. 5 min., of which 12 hours represented solo.

HANWORTH
A charter trip to Plymouth was completed on Sunday last for a film company. Other cross-countries were made to Shoreham, Reading, Portsmouth and Bournemouth. Mr. H. Wood has completed his blind flying course under the instruction of Flt. Lt. R. Duncanson, and Mr. Norman Holden's "Leopard" has been delivered after its C. of A.

HERTS AND ESSEX
Mr. A. Harris, the parachutist, has completed the tests for his "B" licence. He set a fine example to other members by obtaining an average of over 90 per cent. of the marks in the technical examinations, the preparation for which is given free by the club. Messrs. B. J. Chandler, A. G. Bullmore and R. Wyndham have become members.

Of the 67 hours flying done during the week, 40 hours was solo.

HAMPSHIRE
As has already been reported in *Flight*, the Hampshire Aeroplane Club is now approved to give blind flying instruction and a "Gipsy Moth" has been suitably equipped. Mr. K. C. Winton is the instructor, and the course is divided into two categories—one for the "B" licence pilot and the other for private pilots. Although the second course is on the same lines as the other, the length of the tests has been reduced to suit the ordinary individual.

At the conclusion of each course a certificate will be issued with an instructor's assessment and a blind flying trophy is being presented by Mr. Frank Wallis.

Incidentally, it is interesting to record the flying time of the club "Moths" during 1934. The total was 1,866 hr. 30 min., with an average of 622 hr. 10 min. for each machine. Actually the "Cirrus II Moth," used for instruction up to the licence stage, did 120 hours more than the two "Gipsy I Moths."

YORKSHIRE
Club machines flew approximately 15 hours. Flights to Wolverhampton and back were made, and Messrs. P. B. and M. H. Maufe, of Ilkley, have become associate members.

LIVERPOOL
On Grand National night, Friday, March 29, a special dinner will be served in the clubhouse at Speke at 7.30 p.m. There will be dancing until midnight.

Adverse weather conditions have caused the postponement, until Saturday, March 30, of the skeleton map competition. During the past fortnight 91 hr. 15 min. flying have been recorded.

CINQUE PORTS
There was a great improvement in the weather this week, and the flying time amounted to 36 hours, despite the fact that Mr. K. K. Brown, the chief instructor, was away most of the week with 'flu.

Mr. T. H. Villiers and Mr. W. A. Slater have joined the club to take their "A" licences. During the week Mr. Stewart Hordern visited the club from Holland.

NORTHAMPTONSHIRE
New members last week were Mr. and Mrs. J. Munslow and Mr. R. P. Patrick. A number of members have been taking instruction in blind flying.

The continued fine weather brought large crowds to the aerodrome over the week-end, and, given a good summer, there is every hope that the club will have a record season. A short "opening of the season" display will be given on April 7, commencing at 3.30 p.m.

MIDLAND
Lord Nuffield's "Envoy" has returned to Castle Bromwich, where it is being flown by Mr. George Lowdell. Mr. Bentley called during the week in his "Puss Moth," and members made cross-countries to Desford, Filton, Wittering, Pershore, Tollerton and Hanworth.

First solos were made by Messrs. L. Ashforth, D. Duttson and B. Dawkins, and Mr. J. Ellison passed his "A" licence tests. Flying times for the week were 25 hr. 25 min. dual, and 28 hr. 55 min. solo.

BRISTOL
A dinner was given on Saturday by the Bristol and Wessex Aeroplane Club to Flt. Lt. R. W. M. Hall, who has left the club to join Imperial Airways. About fifty members attended, and the chair was taken by Mr. R. Ashley Hall. Among the guests were Lord Apsley, president of the club, and Lady Blanche Douglas. Flt. Lt. Hall was presented with a watch and a cheque from members in recognition of his four and a half years' service as chief instructor.

The club has placed an order with Henlys, Ltd., for a new Avro "Cadet." Delivery is expected in April.

Progress in Ireland

Civil aviation is making slow but steady progress in the Irish Free State. During 1934 the number of new pilots' "A" licences issued was fifteen, bringing the total up to forty-six, and one "B" licence was issued, making a total of sixteen. An indication of the increase in aircraft ownership is shown by the import figures for complete aircraft, which totalled £17,300 in 1934, as compared with £2,775 in the previous year.

Helping Young Pilots

The Air League of the British Empire announced last Thursday that it was ready to make the first fifty grants under its Young Pilots' Fund. The basis of the fund is that every sum contributed by the young men is doubled by contributions, thus reducing by half the cost of flying training. Included in the grants now announced are contributions from the Prince of Wales and Lord Londonderry.

Whitsun Flight in Austria

The Oesterreichischer Aero Club have extended an invitation through the Royal Aero Club to British private owners to take part in the Whitsun flight in Austria from June 7-12. Participants will assemble at the airport of Altenrhein on June 7, between 10 a.m. and 12 noon, when the flight will start. June 9 will be spent in Vienna, and participants will have an opportunity of attending the Austrian Derby, which is the principal event of the Vienna season.

Private owners wishing to take part are requested to communicate with the Royal Aero Club at 119, Piccadilly, W.1.

"Don'ts" for Pilots

During to-day, to-morrow and Saturday pilots must not fly in the vicinity of Aintree at less than 2,000 ft. and must make left-hand circuits.

In the same way the Thames, between Putney and Mortlake, is to be "out of bounds"—save above 2,000 ft.—on Boat Race day. Left-hand circuits must be made.

Finally, Brooklands aerodrome will, in future, be closed between 1 p.m. and 5.30 p.m. on race days, and 2,000 ft. is the minimum height from which interested spectators may watch the racing.

R.Ae.C. and Touring

The Royal Aero Club, in a recent memorandum, remarks that air touring has begun to show a greatly increased vitality. The R.Ae.C. committee, in the course of last year, decided to energise the work by appointing a special private owners' and air touring committee, solely for the purpose of watching and assisting this development. Among the questions handled were the following:—

Convention relating to the cautionary arrest of aircraft, purporting, among other things, to facilitate the resumption of a journey after alighting; attempt to relieve the aircraft users of the heavy petrol tax burden; the de-rating of civil aerodromes; unification of landing and garage fees; Customs carnets—to bring into use an improved form of carnet; Conventions relating to aerial collisions and salvage of aircraft—limitations, etc., of salvage charges; barriers to air traffic—an attempt to stir public opinion at home and abroad against this unnecessary impediment to air travel; signals used in air navigation—standardisation of indications day and night in distress and otherwise relating to aircraft; entertainment of foreign visitors; passports—recommendation for a larger passport capable of carrying more visas, etc., before renewal; recommendation for Customs facilities at a larger number of aerodromes.

Apart from meetings in London, air touring matters have been discussed with other national clubs.

FOREIGN AIRCRAFT

FOR LONG-DISTANCE RACING

"Benny" Howard's Monoplane : Fuel of Three Octane Values Carried

MR. "BENNY" HOWARD, whose famous racers *Ike* and *Mike* are familiar to thousands of visitors to the National Air Races at Cleveland, Ohio, has designed a most interesting long-distance racing monoplane which he has called *Mr. Mulligan*. The machine is a high-wing strut-braced monoplane with a Pratt and Whitney "Wasp" SE engine of 500 h.p. giving a top speed at 17,000 feet of 312 m.p.h.

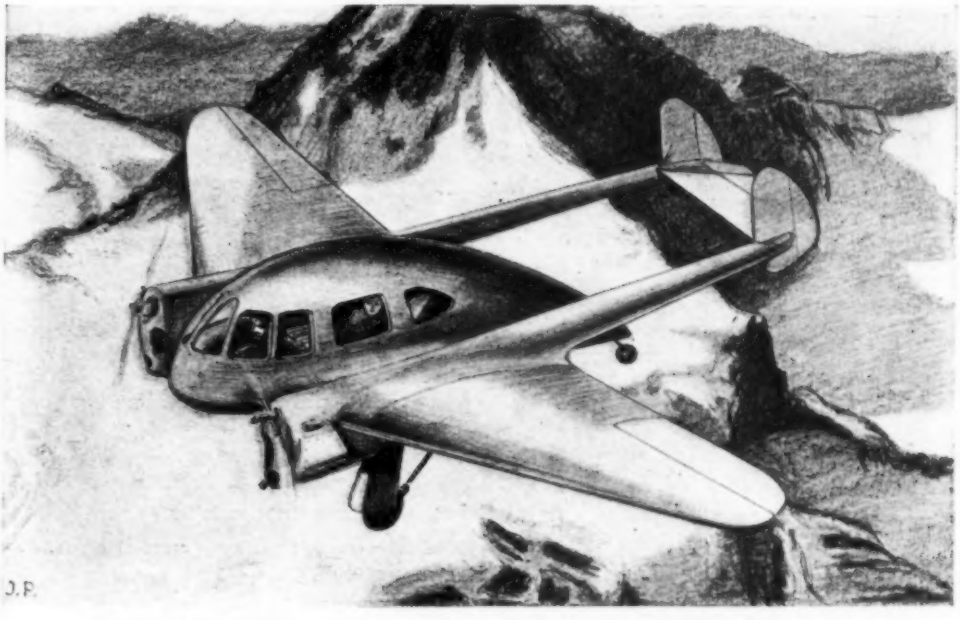
Mr. "Benny" Howard's latest racing machine.

Wood is used for the wings, which have plywood covering and internal bracing. The fuselage is of tubular construction with fabric covering, and the undercarriage is of very clean design, having no axle but being braced with wires. Control surfaces are large and unbalanced.

A carefully designed N.A.C.A. cowling is fitted over the "Wasp" SE engine, which has a 14:1 supercharger drive ratio, 6:1 compression ratio, and is rated at 500 h.p. (2,200 r.p.m., 11,000 feet). One hundred gallons of fuel are carried in the fuselage, 50 gallons in the centre section and 25 gallons in each wing. The fuel in the fuselage tank is of 80 octane, that in the centre section of 87 octane, and the wing tanks contain 100-octane fuel. The idea behind this arrangement is that high octane fuel should be used for take-off, climb and emergency, and that the cheaper fuel should be used for cruising, especially at high altitudes.

It is said that the machine, when fully loaded, takes off in less than 670 feet and climbs to 15,000 feet in fifteen minutes, using 62½ per cent. full power. The initial rate of climb is 4,000 feet per minute, due, no doubt, to the special fuel.

TOWARD THE "FLYING WING"



An artist's impression of the "Crusader." The undercarriage is shown extended.

AN exceptionally interesting four-seater low-wing monoplane, of unorthodox layout, built by the American Gyro Co., of Denver, is at present being tested. With the exception of wing tips and control surfaces it is of all-metal construction, 17ST aluminium alloy being the material employed.

The centre section embraces the two engine nacelles, undercarriage, fuel tanks and cabin structure, and the cantilever wing, 36ft. in span, which is of the "semi-stressed-skin" type, has two easily detachable outer panels, secured by four heat-treated taper pins. Manually operated trailing edge flaps extend outboard from the fuselage to the mass-balanced ailerons.

Flush riveting is used for the covering of the fuselage (which, in plan form at least, seems of excellent shape), and, in fact, for all other metal surfaces. The average cabin width

Foreign Aircraft (Cont.)

is 4ft. "Plastocele," ¼in. thick, is employed for the windows, which seem proportionately larger than those in the majority of American metal machines.

Tests are being conducted with a fixed and a retractable undercarriage. The wheels of the latter type are arranged to fold rearwards and upwards, and each portion, when raised, completes the fairing of the engine nacelles. Hydraulic brakes and a swivelling tail wheel are specified.

The horizontal and vertical control surfaces are mass-balanced, and are supported by two tapered elliptical duralumin "stressed-skin" tubes which fair into the wing behind each nacelle, where they serve as wells for the retracted wheels.

Preliminary tests, according to our American contemporary *Aero Digest*, were made with temporary V.P. airscrews, and the take-off from Denver airport, which is 5,000ft. above sea level, was effected in eight seconds. The landing speed was about 60 m.p.h.

Wind tunnel tests which were carried out with a model of the machine at New York University gave a top speed of 233 m.p.h. With one engine working a speed of 150 m.p.h. should be attained.

The wing area is given as 206 sq. ft., the empty weight 2,000 lb., and the gross weight as 3,000 lb., but probably these figures are approximate only.

ADVANCING THE AMPHIBIAN

America Adopts Grummans for Naval and Coastguard Duties

LATELY the U.S. Navy has adopted the Grumman JF-1 as a "utility" amphibian, and a similar machine, with a different engine, rearranged cockpits and special equipment, known as the JF-2, has been the subject of a production order from the U.S. Coastguard. For the U.S. Navy machines the new Pratt and Whitney "Twin Wasp" fourteen-cylinder two-row radial of 800 h.p. is specified, but the Coastguard J.F.-2's, one of which recently broke the speed record for amphibians, uses a nine-cylinder Wright "Cyclone F" of 710 h.p.

For the purpose of a structural description both types can be considered as a single machine.

Two spars of 17 ST aluminium alloy, with flanges of extruded channel section connected by web plates placed alternately on front and rear faces, are used for the wing, as shown in the accompanying sketch, for which we are indebted to our American contemporary *Aviation*. The ribs are of shot-welded stainless-steel truss construction.

An interesting feature is the interplane bracing system. The two upper planes meet over the centre line of the fuselage, but are not externally braced at that point, although vertical tie-rods running from the fuselage pass between them to anchor a hoisting sling in the top centre section. A wire connects the attachment point of each front centre section strut to a fitting on the lower portion of the fuselage, and another connects the rear strut attachment to a point on the lower front spar. Flying and landing wires in the wing cellule proper are located in the plane of the front lower and rear upper spars.

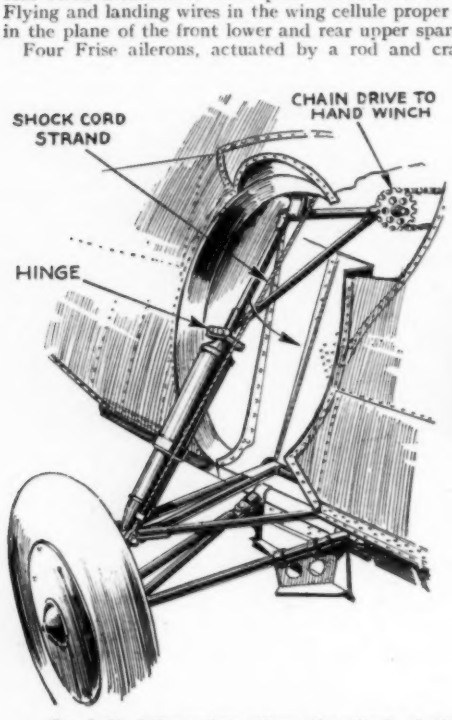
Four Frise ailerons, actuated by a rod and crank system housed in the lower wing, are fitted. These have frameworks of 17 ST alloy, and are connected by streamlined struts.

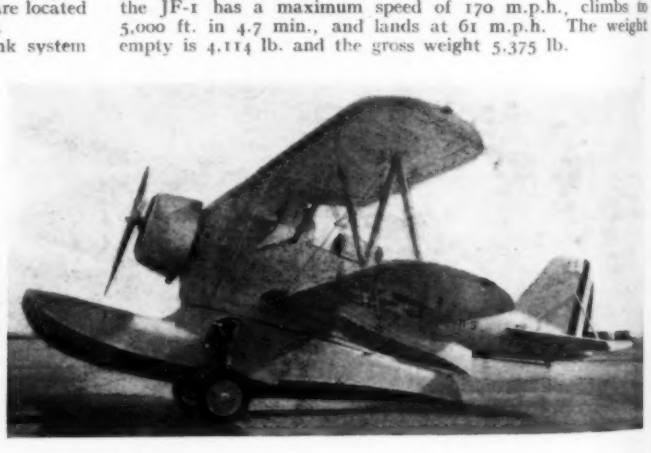
The fuselage, float (or hull) and the compartment connecting them, are also of 17 ST construction. A single step is provided for the float, which embodies bracing of the "crossfloor" truss type, longitudinal stresses being taken by the skin with reinforcement from chine and keel, and from inverted "U" members riveted to the top deck of the forward section. The hull houses a 125-gallon fuel tank, the retractable undercarriage and the lower portion of a cabin, which serves for everything from a "workroom" for photographic survey work or target locker (the U.S. Navy uses its JF-1's for aerial target towing) to a stowage for two stretchers.

Stressed-skin covering on cross-frames is employed for the fuselage and is reinforced by light longitudinal members which are not continuous through the cross-framing. Joints, in the main, are riveted.

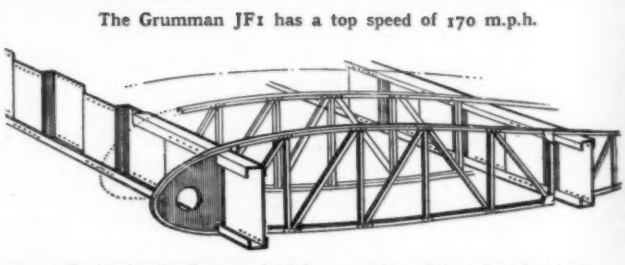
The landing gear retracts completely into the float and is operated by a hand-winch through a system of chains and sprockets. About 45 turns are required to retract or lower the gear, the weight being counterbalanced by a strand of shock absorber cord. Wheel brakes are fitted, and as the main landing wheels are drawn up the tail wheel also retracts. This wheel, although of the swivelling type, may be locked in its central position at the pilot's discretion.

Full performance and loading figures are not available, but the JF-1 has a maximum speed of 170 m.p.h., climbs to 5,000 ft. in 4.7 min., and lands at 61 m.p.h. The weight empty is 4,114 lb. and the gross weight 5,375 lb.





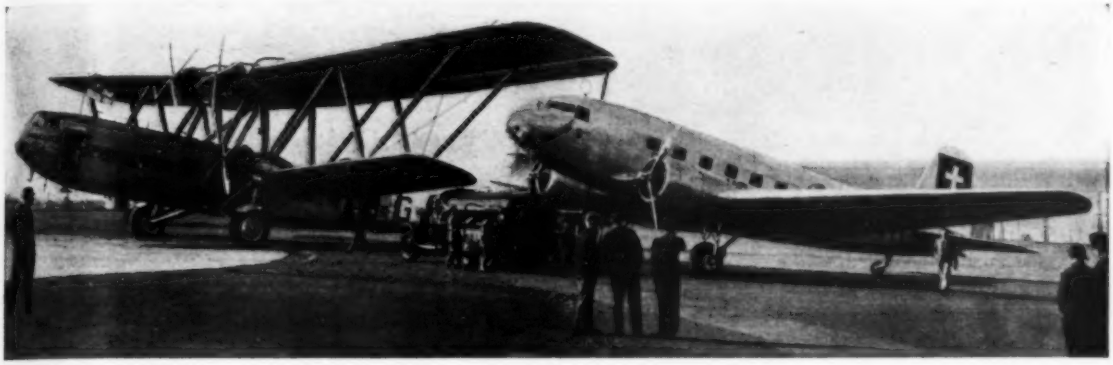
The Grumman JF1 has a top speed of 170 m.p.h.



One half of the undercarriage, the wheels of which retract flush with the float, and (right) a portion of the wing structure.

COMMERCIAL AVIATION

— AIRLINES — AIRPORTS —



DEMONSTRATION : One of the two Swissair Douglas machines, which were demonstrated recently at Croydon, being refuelled beside the Imperial *Heracles*. Actually, the "Scylla" class will probably be used, as last year, for our own part of the Zurich service. The Government has offered a prize of £25,000 to encourage the production of medium-sized commercial machines.

CROYDON

Political Charters : The Swissair Douglas : A Trial Run to Budapest : The Time Travellers Return

DURING last week Mr. Anthony Eden and Sir John Simon both chartered special D.H. 86 aeroplanes from Imperial Airways. Mr. Eden, piloted by Capt. Horsey, went to Paris and then flew on to Amsterdam on Sunday morning to meet Sir John Simon. Sir John himself left Croydon on Sunday morning, piloted by Capt. Perry, and it was either by remarkably good staff work or by an impressive bit of luck that the two D.H. 86 machines met over Schiphol Airport, Amsterdam, and flew in formation before landing. Capt. Perry then flew the two British statesmen on to Berlin.

It is an amusing reflection that Sir John Simon left Croydon with no more military pomp than was afforded by a handful of men in bowler hats armed with umbrellas and arrived in Berlin to be welcomed with drawn swords by Herr Hitler's bodyguard.

In conversation with one of the old hands amongst traffic managers the other day, apropos the fact that statesmen now travelled quite automatically by air, he remarked that not very long ago it was impossible to get the various Government departments to send so much as a King's Messenger abroad by air.

On Tuesday, March 19, the two "Swissair" Douglas machines were demonstrated at Croydon. One of them flew direct from Basle, a distance of 485 miles, with fourteen passengers, in 2 hr. 29 min. These are machines which show their paces better on long, steady flights at 12,000ft. than when demonstrated in a series of short flights.

Mr. J. W. Lewington, known as the "flying referee," has just made his sixth flight to the Continent during this season. He finds that flying is restful, and sleeps most of the time; he also stresses the fact that he arrives without that grimy, travel-stained feeling.

One of the new dual-control D.H. 86 machines left Croydon on Monday, piloted by Capt. Percy, for a trial run along the route to Budapest to be opened on April 1 by Imperial Airways. Mr. Woolley-Dod and Mr. Waugh went with the machine. A service will be run every week-day, leaving Croydon at 8 a.m. from April 1 to 13, at 9 a.m. until May 1, and thereafter at 11 a.m. The differences during April are due to the introduction of earlier summer time in Belgium. The route is *via* Cologne, Leipzig, Prague and Vienna.

On Monday the Imperial mid-day machine from Paris brought in Mr. F. G. L. Bertram, C.B.E., Deputy D.C.A., with Mr. Noel Guinness, M.P., Parliamentary Secretary to the Under-Secretary of State for Air. Eight weeks ago they set out to fly to Sydney on air mail matters. They spent twenty-six days in the air and thirty days on the ground.

At many of the places called at they were able to complete their business on the day of arrival and continue the following morning in the same machine.

Mr. Bertram is sixty years of age, though nobody would suspect it, and the main thing he found was that flying is not fatiguing when travelling on business. He brought back a large selection of tropical birds, and Mr. Noel Guinness produced to the Customs an Oriental straw hat of phenomenal circumference.

A. VIATOR.

The Seadrome Beacons

Further information is now available concerning smaller test seadromes for radio and meteorological services, the possibilities of which for use on the Pacific route were mentioned in *Flight* of March 14.

These smaller seadromes would resemble the anchorage buoy, illustrations of which have been published, and each would cost something in the neighbourhood of £40,000. The stations would be provided with a crew of five, lifeboats and a motor patrol boat with which to send fuel and supplies to machines which may be forced down. Each would be equipped as a long-range lighthouse and radio station.

Preparing for the Pacific

During the week-end the special Sikorsky S.42 covered non-stop the 2,500-mile round trip between Miami, the Virgin Islands and Miami. On returning to its base the S.42 still carried petrol for another 500 miles, yet it had already exceeded the distance between San Francisco and Honolulu on the trans-Pacific route. Pan-American Airways are apparently pleased with the action of their special radio compass which proved its ability to pick up signals at a range of 1,800 miles.

This flight effectively disposes of the doubt felt in many quarters that the S.42 was capable of flying 3,000 miles non-stop, but it remains to be seen whether a payload could be carried in these circumstances.

Commercial Aviation

AN AMBITIOUS SCHEME

Airports as "Productive Public Works": Mr. O. E. Simmonds' Suggestion

APOLOGISING for introducing the subject during the debate on the Air Estimates, but pointing out that the moment was a fitting one, Mr. O. E. Simmonds, in the House of Commons last Wednesday, put forward some enterprising suggestions on the subject of Britain's internal air lines and airports.

He said that some five years ago the Air Ministry had laid it down that every town or city with over 20,000 inhabitants should have an aerodrome; that would suggest 275 aerodromes throughout the British Isles, and, even so, would mean that such important towns as Malvern, Boston, Chichester or Skipton would have no aerodrome. If, therefore, they said that 300 aerodromes were required they would not be far from the mark.

But what, after sixteen years of civil aviation in this country, was the actual measure of achievement? It was that they had twenty municipal aerodromes in existence, and sites purchased for ten more.

After praising several municipalities which had taken up the matter with zest, Mr. Simmonds said that, generally speaking, municipal enterprise in this respect had completely failed. It was not hard to see the reason. In the early days a municipal aerodrome was held out to be a financial asset, whereas those who possess them now know perfectly well that they are not a financial asset, but a liability. If towns owned the stations and the railways took the fares the position would be similar.

He suggested that the problem should be investigated *de novo*. Here was the opportunity for the expenditure of public money on productive public works. He suggested that there should be first-class airports of 200 acres, costing approximately £150 an acre, or a total for each airport, including preparation, building and equipment, of £125,000. Probably there would be forty first-class airports, and thus their total cost would be £5,000,000.

Then there would be a second class of airport, costing possibly two-thirds of this figure, £80,000; in this category would be sixty airports, and approximately £5,000,000 would again be necessary. The balance of 200 of the 300 ports which would be necessary could be regarded as in a third class, costing a third of the cost of the first-class ports, and thus requiring £8,000,000 in all.

After touching on several practical points in air line operation which he had observed while in America, Mr. Simmonds said that the whole scheme could be carried out in a first-class style and the country equipped for ever for a sum of approximately £20,000,000. He then drew certain comparisons with the Road Fund to show that this sum was not so startling as it appeared.

Provincial's New Aerodrome

The new aerodrome at Denbury, mentioned in *Flight* of March 7, will be opened by the owners, Provincial Airways, Ltd., on Saturday, April 6, at 10 a.m. Denbury is about six miles north-west of Torquay. Private owners and others are cordially invited to attend.

Zeppelin Operating Company Formed

A new company with a capital of £477,500 (at par) was formed on March 22 to organise regular airship services for passengers, mail and freight. More than half of the capital has been contributed by the Zeppelin Company, and the balance by D.L.H. Dr. Eckener is chairman of the board.

At Heston

The demonstration Douglas D.C.2 which is destined for the Swissair service to Zurich, visited Heston last week. Among the passengers were the Swiss Ambassador with his wife and daughter, Major Nabholz of the Swiss Air Ministry, and Major Mayo of the British Air Ministry. Mr. A. F. Burke, service manager at Heston, who also travelled in the aeroplane, showed the party round the hangars and workshops.

Advertising in the sky has adopted yet another device. Capt. G. Birkett, in conjunction with Air Services, Ltd., has made a series of successful experiments with the Airwork School Autogiro in towing, not a banner, but an upright poster. The poster, made of five-foot letters stretched on a sort of rope-ladder, is about 120 ft. long. At one end two wind-socks act as stabilisers, while at the other end is some 350 ft. of cable, attached to the Autogiro. The poster is first spread along the ground with a man holding the first letter erect. The Autogiro takes off towards it, in a parallel line, and is well off the ground by the time the slack of the cable is taken up.

The Batavia Service

After June 12 the K.L.M. Batavia service will be operated twice a week with the company's new Douglas machines. The new equipment will enable the single journey to be covered in 5½ days.

Pacific Alaska's New Routes

In *Flight* of February 28 the possibility of an extension in Pacific Alaska Airways' system to Juneau, in Canada, was mentioned. On April 2 the new route will be opened between Juneau and Fairbanks.

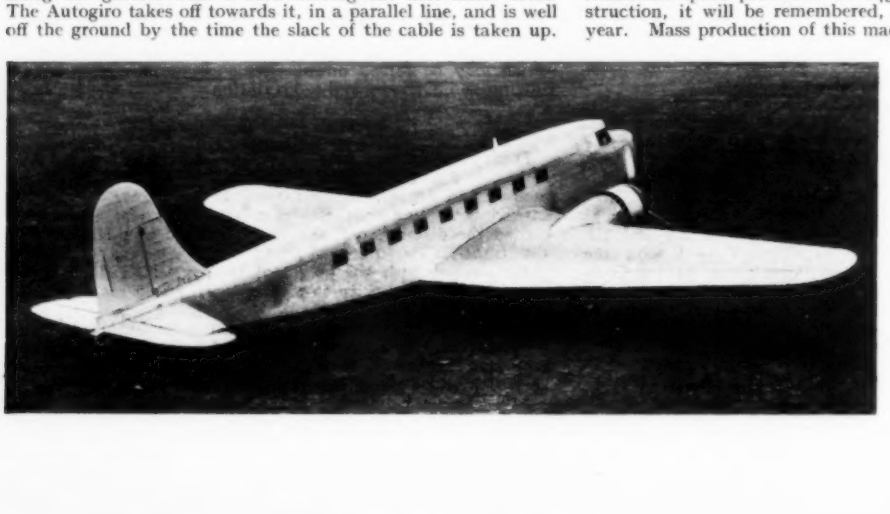
New Commercial Types in the U.S.S.R.

Government tests of a new Soviet fast mail and passenger machine were, it is reported, recently completed. This machine has been designed by the Kharkov Aviation Institute under the direction of Engineer Neman. Its maximum speed is given as 205 m.p.h.—bringing Tiflis within 11 or 12 hours of Moscow.

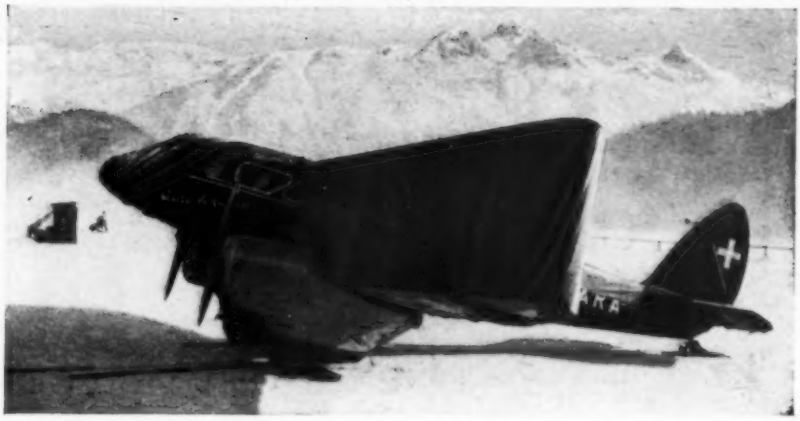
The Khai-1, as the machine is known, will carry six passengers, and has a retractable undercarriage. It is of all-wood construction with a Soviet motor. The Civil Air Fleet will shortly receive the first batch of these machines and the first trial flight over the Moscow-Kiev-Moscow route will be made.

Incidentally, the first Soviet passenger flying boat, the single engined MP-1, was also tested recently. The cruising speed of this machine is 125 m.p.h. An air service will be established between the most important centres on the Black Sea coast. Apparently special skis have been developed for this boat.

After prolonged work on the new all-steel welded STAL-2 this machine has also completed its tests, during which its maximum speed proved to be 143 m.p.h. The STAL-2 construction, it will be remembered, was exhibited in Paris last year. Mass production of this machine has been started.



DOUGLASIAN: On the power of two 700 h.p. geared and supercharged radials (which are Pratt & Whitney "Hornets" built under licence) the new Fiat G.18 shown here has a maximum speed of 210 m.p.h. carrying eighteen passengers, luggage and mail with fuel for 500 miles



SHROUDED : The D.H. "Dragon Rapide" now used by Aero St. Gallen on services between St. Gallen, Zurich and Berne. During 1934 this company, which also owns a "Puss Moth" and a "Leopard Moth" and which has been doing school and charter work since 1931, carried 3,393 passengers. The "Rapide" was recently flown by Capt. Rieser from St. Moritz to Zurich with a hospital case. There are no hangars at St. Moritz—hence the funereal appearance of their latest acquisition in this picture

Carrying the Syrian Mail

For some time negotiations have been in progress concerning the carrying of mail from Syria to Egypt, and on March 1 the mail arrived at Almaza in a Misr Airwork machine. The normal Palestine service is used and the mail is carried from Haifa by car.

Across Albania

It is reported that Ala Littoria, the Italian merger company, has obtained a monopoly of air services in Albania for the coming ten years. This monopoly should be extremely valuable, as Italy already runs a service to Salonika. A few years ago Albanian services were largely in German hands.

An Aerodrome Site

Manufacturers and others may be interested to learn that there is land, bordering on the Thames near Erith, eminently suitable for development as an aerodrome. The Erith Development Committee will give every possible assistance to enquirers.

Trans-Siberian

Plans are under consideration for the development of an air line between Archangel and Khabarovsk, on the borders of Manchukuo. Various other lines will radiate from Tiksky Bay. As the last portion of the trans-Siberian railway itself runs along the Manchukuo frontier, this line might be useful in case of trouble.

The Tasmanian Service

The service *via* King and Flinders Islands, across the Bass Strait between Tasmania and Melbourne, was resumed again late in December after an interruption due to the unfortunate loss of the *Miss Hobart*. Holyman's Airways, Pty., formerly known as Tasmanian Aerial Services, Pty., Ltd., are carrying on a tri-weekly service between Essenden aerodrome and Western Junction, using D.H.86s, *Miss Launceston* and *Golden West*. At the end of November 1,692 passengers had been carried by the company—including those carried on the trans-Tasmanian service from Brighton (Hobart) to Western Junction (Launceston).

A Tata Year

As previously reported in *Flight*, Tata Sons, Ltd., completed, on October 15, 1934, their second year of air mail operation, and had again achieved a regularity of 100 per cent. 140,000 miles were flown and 16.7 tons of mail were carried during the second year.

It is interesting to note that, for the year 1933, the ton-mile figures for mail and freight were 9,686.6 and 109,56 respectively, and the passenger miles were 5,495. For 1934 these figures were 15,627.9, 45.51, and 8,245. Tatas have recently ordered two direct control Autogiros for their Karachi-Madras service. Before the machines are put in service, however, they will be engaged in demonstration flights. One was sent out last month on a tour of Northern India. At all the centres visited great interest was shown, and a number of important officials, both civil and military, have taken an opportunity of making flights in the machine.

The "Graf Zeppelin" Out Again

Last Monday the *Graf Zeppelin* made this year's first practice flight over Lake Constance. The ship will leave again on its fortnightly South American trip on April 6.

Norwich—Leicester

Crilly Airways, of Doncaster, are to open a twice daily service between Norwich and Leicester. At Leicester, of course, connection can be made with Provincial Airways' Southampton-Hull service. At Hull the passengers may travel to Liverpool, Amsterdam or (after May 1) to Newcastle and Aberdeen. But one does not imagine that the time-tables can be made to fit so nicely.

Passengers to Australia

Next month—after April 12 to be exact—the whole route to Brisbane will be open to passengers. Up to the present, of course, they have been left at Singapore. The fare will be £195 to Brisbane from London—which appears reasonable enough when it is remembered that the de luxe ocean fare is about £140 to Sydney. Incidentally, the London-Singapore fare will be reduced after April 1 from £180 to £156.

MacRobertson Pilot's New Post

Sqd. Ldr. MacGregor, of MacRobertson Race fame, and Capt. G. E. Bolt have been appointed chief pilots of East Coast Airways and Cook Strait Airways respectively. They will shortly leave for England to take delivery of machines.

Capt. Bolt has some 7,000 hours to his credit, having started his flying career with Walsh Bros., of Auckland, pioneers of aviation in New Zealand, and has been actively engaged in flying ever since. In 1930 he was in this country and selected a Saro "Windhover" flying boat for Dominion Air Lines. The projected line never materialised, and the machine was finally disposed of in Australia. Since that date he has been the chief ground engineer of the Wellington Aero Club. He is an exceptionally fine pilot as well as being one of New Zealand's best aeronautical engineers.

The Week at Hatfield

Jersey Airways have now taken delivery of their second and third D.H.86s, *Grouville Bay* and *St. Catharine's Bay*. These, it will be remembered, have swing-over controls and the whole fleet is, or is to be, equipped with sensitive altimeters and rate of climb indicators.

The French Air Ministry "Comet," lately the property of Mr. Bernard Rubin, has been out on test a good deal recently. The French A.M. has ordained that a generator should be placed in the nose and, as the "windmill" is of large diameter, the "Comet" appears for all the world to have been fitted with an auxiliary power unit.

M. Louis Mahieu, Director of the Banque Nationale de Belgique, has taken delivery of his "Rapide." M. Stampe, the D.H. Belgian representative, came over with him and the machine was flown back by M. Stampe, Junr. Auxiliary tanks have been fitted, giving the machine a maximum range of about 1,100 miles. During the week Mr. Eric Wylie arrived to collect the "Leopard" which has been purchased by the Tanganyika Diamond and Gold Development Co.

A "Leopard Moth" has been bought by Mr. **de Kock**, Director of the Royal Dutch Shell group

HERE and THERE

The Coupe Deutsch

WHEN entries for the 1935 Deutsch de la Meurthe Cup Race closed on Wednesday of last week eight nominations had been received. The Caudron Company had entered five machines, and François Baudot, Emile Regnier (Regnier Motor Co.), and Guy Bart had entered one each.

The race will be flown, weather permitting, at Etampes Aerodrome on May 19 (or as soon thereafter as possible). It will consist of two sections of 1,000 km. (625 miles), with an hour's interval between them. The maximum cylinder displacement of the engines will be limited, as usual, to eight litres.

The 1935 regulations require that each contestant shall make a trial flight of 500 km. (312½ miles) between April 2 and May 2, at a speed of not less than 300 km./hr. (188 m.p.h.). The take-off must be made in less than 500 metres (1,625 ft.), and the machine must clear an obstacle consisting of two cords stretched across the field at a height of one metre from the ground and at a distance of 50 metres apart. The first cord will be 500 metres from the point of take-off. The machine must also land within a distance of 500 metres; it must clear two obstacles similarly placed as mentioned above and come to a complete stop within 500 metres of the second one.

It is reported that the Renault Company, whose engines will be fitted in the five Caudron entries, is developing a new inverted vee-twelve air-cooled engine of eight litres, which when supercharged will produce 500 h.p. or more.

Mr. Ivor McClure's Air Ministry Appointment

It is stated that Mr. Ivor McClure is to go to the Air Ministry Directorate of Civil Aviation as Chief Operational Advisor to the Director-General. The appointment takes effect from the beginning of April.

Mr. McClure's work in charge of the Aviation Department of the Automobile Association and with the aviation section of the London Chambers of Commerce has always been outstanding. He has shown himself to be a man of vision and great capability, and, therefore, eminently suitable to be closely associated with the development of both internal and Empire air routes. He has a clear understanding of the needs of air operators, and a very wide experience of the best lines of development for aerodromes, both of which attributes will prove of inestimable benefit in his new work.

R.Ae.S. Lecture Postponed

Sqn. Ldr. H. G. Brackley's lecture before the Royal Aeronautical Society on "Piloting Commercial Aircraft," arranged for March 29, has been postponed. Capt. G. de Havilland's lecture before the Society on "Commercial Aircraft" will be given on Monday, April 15, instead of April 12, as previously announced. It will, however, be held as usual at 6.30 p.m. at the Institute of Electrical Engineers, Savoy Place, Victoria Embankment.

Death of Mr. R. H. Hutchinson

Flight regrets to record the death last week of Mr. Robert Haller Hutchinson, after an illness that became more acute after his return from America. Mr. Hutchinson, who was only in his forty-first year, was largely responsible for the production of the "Gipsy Six" engines in the D.H. "Comets," and he joined the staff of the De Havilland Aircraft Company in 1931 at a time when the "Gipsy Major" engine was about to undergo type and development tests.

Before joining De Havillands he was with Armstrong-Siddeley Motors, of Coventry, and later with Napiers, of Acton.

Towards the end of the summer last year Mr. Hutchinson went to America to study the manufacture of the controllable-pitch airscrew at the Hamilton factory, and it is largely through his work that this type of airscrew is now being manufactured by the De Havilland Company as a wholly British product.

De Havilland Aircraft Issue

The De Havilland Aircraft Co. has offered to shareholders 100,000 of the 200,000 ordinary £1 shares created at the recent meeting of the company at the price of 40s. a share. The new shares rank for dividend as from April 1 next and are offered to shareholders registered on March 16 in the proportion of one new share for every four held by them.

Mr. E. C. Gordon England

It is announced that Mr. E. C. Gordon England has relinquished his position as Director of the Vacuum Oil Company, Ltd., in order to take up the post of Joint Managing Director of General Aircraft, Ltd. Though he has always been closely in touch with aviation matters, his many friends in the industry will welcome him back in the sphere of aircraft manufacture, for he was Chief Designer to the Bristol Company in pre-War days, afterwards being associated with Samuel White, of Cowes, and with Frederick Sage during the War. We may also recall his pioneer work in collaboration with Jose Weiss, first on gliders and afterwards on power-driven aeroplanes.

The Thousandth "Gipsy Major"

The one thousandth "Gipsy Major" engine was recently delivered. The production programme for De Havilland engines is steadily advancing; at present thirteen "Gipsy Majors" and seven "Gipsy Sixes" per week are produced. From the beginning of April the production of the latter engine—two hundred examples of which have already been built—will be increased to eight per week. Since the production of the first "Gipsy I" in 1928 about four thousand "Gipsy" engines have been manufactured.

Change of Address

The London office at 139, Queen Victoria Street, E.C.4, of Boulton Paul Aircraft will be closed as from March 31, and any correspondence after that date should be addressed to the company at Norwich.

"Chromium-plated" Oil

Designed to obviate cylinder corrosion and the formation of sludge in the oil sump, the new Wakefield "Patent Castrol" was announced last week.

During the oxidation of a lubricating oil which occurs at the high temperatures met with in an internal-combustion engine, corrosive organic compounds are formed which seriously contribute to the wear of the cylinder walls. The addition of oil-soluble forms of chromium to a lubricating oil has been proved to combat these corrosive compounds and N.P.L. tests in this connection have been most satisfactory.

Deterioration of oil due to oxidation with consequent engine lubrication failure has also been the cause of much research work, and is combated by the introduction into the oil of an anti-oxidant—a substance which inhibits the retention of oxygen in the oil, and therefore minimises sludging and prolongs the life of the oil. In the case of Wakefield "Patent Castrol," a tin compound is added, and, as is shown by N.P.L. tests and the results obtained by Sir Alan Cobham, who used this new oil for his air fleet last season, the addition of tin and of chromium has produced excellent results.

NEW COMPANIES

BROOKLANDS AIR TAXIS, LTD., Brooklands Aerodrome, Byfleet, Surrey. Capital £1,300 in £1 shares. Objects: to carry on business as air transport contractors and to establish, maintain and operate air lines and communications; proprietors of tourist, travel and other agencies, etc. The directors are:—Chas. F. O'Connell, 4, Oak Parade, High Road, Byfleet; Jules A. Valetta, 10a, Bryanston Mews, Upper George Street, W.1; Noel F. Henkel, 72, Hampton Terrace, St. John's Wood, N.W.8; all pilots. Solicitor: F. G. Bowles, 252, High Holborn, W.C.1.

FLYING TRAINING, LIMITED, Hanworth Air Park, Hanworth, Middlesex. Nominal capital £20,000 in £1 shares. Objects: to establish and maintain institutions for instructing and training persons in the control, navigation and management of air, land, sea and other craft, and in the science of flying and motoring, etc. The directors are:—Norman W. Blackburn, Addiscombe House, Elloughton, E. Yorks (director of North Sea Aerial & General Transport, Ltd.), and Arthur A. Moller, M.C., F.C.A., 11, Eaton Terrace, S.W.1 (C.A.). Solicitors: Joynson-Hicks & Co., Lennox House, Norfolk Street, W.C.2.

MAYO COMPOSITE AIRCRAFT COMPANY, LTD. Nominal capital of £95,000 in £1 shares. Objects: to acquire any patents relating to inventions or processes for the production, manufacture, sale, treatment, improvement, application and use of aeroplanes, seaplanes, airships and aircraft of every kind, and to carry on the business of manufacturers of and dealers in aeroplanes and aircraft of all kinds, internal combustion engines, motor cars and cycles, etc. The subscribers are:—H. N. Sporborg, solicitor, and Conyers Surtees, solicitor. Solicitors: Slaughter and May, 18, Austin Friars, E.C.

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AERONAUTICAL PATENT SPECIFICATIONS

Abbreviations: Cyl. = cylinder; i.c. = internal combustion; m. = motors. (The numbers in parentheses are those under which the specification will be printed and abridged, etc.,

APPLIED FOR IN 1934

Published March 28th, 1935.

224. BOULTON & PAUL, LTD., and NORTH, J. D. Heat-exchangers particularly suitable for heating air by the exhaust of internal-combustion engines. (424 853.)